The Builder.

VOL. LIII. No. 2331. SATURDAY, OCTOBER 8, 1887.

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Our National Maps.

IT seems somewhat strange that the national maps of a kingdom such as ours, the mother of vast colonies, to whose inhabitants every foot of British soil is, or should be, dear and sacred, and who are destined to hand down to a remote posterity, not only our language, our customs, and our laws, but also our local histories and traditions, should be only now, at the close of the nineteenth century, nearing their completion, and that it is only now that the colonist is able to procure an authentic and explicit map of the parish where his forefathers lived and died, where he himself, perhaps, first saw the light, and the names of whose homesteads, woods, fields, streams, commons, and winding lanes have been handed down to his children as household words.

Turning from a perhaps somewhat poetical view to one of a practical nature, it seems still more strange that a business-like nation such as ours should have ignored to so late a period in its history the immense advantages to be obtained from a national survey of the kingdom, and that the War Office, the county, parish, city, town, and village authorities; the railway, canal, gas, water, mining, and other companies; fishery boards, land-owners, tenant farmers, parochial clergy, and others, to say nothing of antiquaries, students of history, geology, mineralogy, botany, &c., should only recently be able to obtain efficient and authentic maps of the parts of the kingdom in which they may be interested.

While the National Survey has been in hand generations have come and gone, and though its late commencement and its still more tardy execution are to be regretted, delay has allowed the use of recent discoveries of science, and the Ordnance Survey authorities have thus been enabled to present us with a finished work which, even in 1867, was rightly pronounced by competent French authorities to be "sans précédent et qui devrait servir de modèle à toutes les nations civilisées."

Our national maps, faithful and true pictures as they are of the land of our inheritance, with all its venerable histories and traditions, are yet far from being sufficiently known, appreciated, or understood, even by those whose training should naturally enable them to value the skilled execution displayed, or delight in the remarkable collection of geographical, historical, topographical, and antiquarian detail that is laid before them.

In time, doubtless, those interested in the training of the young,—the men and women of the next generation,—will appreciate the parish sheets of the Ordnance Survey, which can now be procured at such trifling cost, and, mastering the details themselves, will learn with surprise what a valuable source of instruction the maps can be made; how great a love for home and country can, by their aid, be evoked; and what healthy interest in the study of history, botany, geology, &c., can be called into existence and steadily maintained.

Country walks, fishing excursions, visits to ancient objects, or historical sites can be, step by step, traced on the map; distances, areas of fields, woods, and commons, noted and compared; heights, inclinations of roads, falls of streams, can be observed; and memoranda made as to the haunts of the *fauna*, and as to the localities of different botanical and geological subjects. In short, in careful and appreciative hands, the parish sheets of the Ordnance Survey could be made to play a most important part in the education of the young, for, apart from the instruction to be derived from them in regard to archæological and historical study, who can doubt the good effect of children being early trained to observe heights and distances, and to judge of areas, especially in the case of boys who are destined to follow many of the professions,—to become military commanders, engineers, architects, or surveyors?

Of the various classes of national maps issued by the Ordnance Survey Department, there are three of chief importance, viz., those on the respective scales of

$$\frac{1}{10560} \quad \frac{1}{2500} \quad \text{and} \quad \frac{1}{500}$$

or, in other words, on the scales of 6 in. to the mile, 25·344 in. to the mile, and 126·62 in. to the mile, which said scales are further designated as the county, parish, and town scales.

It is much to be regretted that instead of the county scale of 6 in. to the mile $\left(\frac{1}{10560}\right)$ the slightly larger scale of 6·336 in. was not used, and of which the equivalent is the fraction $\frac{1}{10000}$; for then we should have had the parish scale an equi-multiple of the county scale, just as the town scale is of the parish,—an immense advantage, but one which engineers and surveyors can, perhaps, alone fully appreciate.

Unfortunately, the country was, in the early days of the Survey, too much wedded to the duodecimal subdivision of the lineal foot, and to the octave subdivision of the inch, for Parliament to sanction such an innovation as a 6·336 scale; and so we were doomed to have in our county sheets 1 lineal inch representing 10,560 lineal inches on the ground, instead of the more readily handled, more easily subdivided, and more promptly reckoned number of 10,000 inches.

The credit of proposing the $\frac{1}{2500}$ scale for the parish sheets is due to Capt. Dawson, R.E., who in 1837 strenuously urged its adoption.

In 1853 the question of the scale was still undecided, and the Treasury consulted the most eminent scientific societies and men of science in the kingdom on the subject, with the result that opinions were divided in favour of a scale of 24 in. to the mile and one of three chains to the inch, the latter being the scale on which the old, unofficial, and consequently very inaccurate, maps had been prepared for the use of the Tithe Commissioners.

If these two scales be, by the simple rule of proportion, converted into fractions, they will appear as $\frac{1}{2640}$ and $\frac{1}{2376}$

The supporters of the $\frac{1}{2500}$ scale now seeing their chance, urged that their scale was a mean between the two proposed scales; that having been the scale sanctioned by Napoleon I. for the Cadastral Survey of France, it had been found admirably suitable; that it was easily divisible; and, finally, that one square inch on a map of this scale exactly represented one English acre, which last fact, considering the scale is of French origin, is somewhat curious.

It was thus the even now much-wondered-at and ignorantly-abused scale of 25·344 in. to a mile $\left(\frac{1}{2500}\right)$ came into use.

The town scale of $\frac{1}{500}$ happily followed, and to this scale all towns of more than 4,000 inhabitants are laid down.

Our city and town authorities require to be furnished with a block plan, amongst others, of all new buildings proposed to be erected within their jurisdiction. At present there is no particular scale, except a minimum one, prescribed for such block plans, but with the splendid town maps now furnished by the Ordnance Survey Department, city and town authorities would do well to require all block plans sent in to them to be on a scale of 41·66 ft. to the inch $\left(\frac{1}{500}\right)$, so that such plans could be at once transferred to their own maps, by which means the latter could be properly and effectively kept up to date.

Architects, in many cases, prepare their

drawings on a scale of 8 ft. to the inch, which is equivalent to $\frac{1}{96}$. If, however, a scale of $\frac{1}{100}$ were used, their drawings would be on a scale exactly five times the size of the Ordnance town scale, and thus we should have our buildings, our towns, and our parishes all laid down in harmony with each other, to very great national advantage and economy. Not, however, until the decimal subdivision of the fact is generally adopted in place of the present tedious and troublesome duodecimal sub-division can such a change be looked for.

The system of the Ordnance scales having been discussed, it will be interesting to note how the kingdom has been divided and sub-divided for the purpose of giving the public plans of convenient size, and suitable for ready reference; and the following explanation, though in reality the order is inverted, will, perhaps, suffice.

Parallel north and south lines being drawn at a distance from each other of six miles are crossed by parallel east and west lines at intervals of four miles, and the whole kingdom is thus broken up into rectangular sections, each containing twenty-four square miles. These sections, being laid down on a scale of 6 in. to the mile, give convenient sized maps of 3 ft. by 2 ft. The sections of which each county is composed are known as its county sheets, and are designated by Roman numerals. Small key county maps, on which all the parishes are delineated, are published, showing where these rectangular sections fall and the numbers of the same, and thus one is able to select at once the particular sheet or sheets required.

Again, each county sheet is subdivided into 16 equal rectangular sections, numbered consecutively from 1 to 16, and these sections being laid down on a scale of $\frac{1}{2500}$ give us what are known as parish sheets. For each parish a key map is also published, and by its aid all the parish sheets which go to form the complete map of the parish can be at once selected; and since the scale of $\frac{1}{2500}$ is nearly four times the size of the 6 in. $\left(\frac{1}{10560}\right)$ scale, each sixteenth portion of the latter, when redrawn to a scale four times as large, will give a map almost the same size as the parent map, which size, as we have seen above, is very convenient.

The quantity of ground shown in a parish sheet is the sixteenth part of twenty-four square miles; that is, $1\frac{1}{2}$ square mile or 960 acres.

Where any town containing more than 4,000 inhabitants exists on the parish sheets, these sheets are subdivided into twenty-five equal rectangular sections, and each section being enlarged five times, *i.e.*, to a scale of $\frac{1}{500}$ attains the exact size of the parent sheet. These sections are numbered consecutively from 1 to 25. Each town is provided with a key map, similar to the parish key maps, and hence the town sheet or sheets are readily selected.

In purchasing Ordnance sheets through a local agent, or ordering the same from London, care must be taken to quote the correct number (Roman numerals) of the county sheet required. Should a parish sheet only be wanted, its proper number, which lies between 1 and 16, must be written after the Roman number of its parent county sheet; and should a town sheet be required its proper number, lying between 1 and 25, should be written after the number of its own parent parish sheet.

In order to comprehend the system on which the parish sheets are drawn recourse must be had to the "Book of Reference" published for every parish, which contains an index map of the parish, an explanation of all the terms and symbols used, and the area, to the thousandth part of an acre, of every field and enclosure.

The Ordnance Survey Department has taken a wise and advanced step in giving the areas of all the enclosures in the kingdom in statute acres and decimals of acres only, thus finally abolishing "customary" land measurement, and tending to do away with the subdivision of English acres into roods and perches. Allusion has been already made to our tedious and troublesome subdivision of the lineal foot; the same objections stand good against our present subdivision of the acre, and equally, if not more so, against our cumbersome ton of 2,240 lb., with its subdivisions into hundredweights, quarters, and stones. The American and Canadian system of expressing all weights in pounds only, until the "short ton" of 2,000 lb. is arrived at, is much to be admired, and probably a change in our system of weights and measures in the direction shown would do more to further the collection of valuable agricultural statistics than generally could be believed.

It will be noticed that in addition to a scale of feet, the Ordnance maps are also furnished with a scale of chains and links. Gunter, the mathematician, more than two centuries ago, conferred a benefit on his country by the introduction of a chain of such a length that ten square chains, *i.e.*, an area ten chains long by one chain broad, were equal to one statute acre. Gunter's chain, the length of which is 66 ft., is divided decimally into 100 links, and hence 100,000 square links represent one acre. Thus the acreage of any piece of land can be found by simply multiplying the mean breadth in links by the mean length, and dividing the product by 100,000, the answer being the acreage to a thousandth part of an acre.

For ready reference to Ordnance sheets a convenient method will be found to endorse on each of the four corners of the back of every sheet its proper numbers, and the sixteen subdivisions of each county sheet being rolled together will thus form one family or group, whose surname is, as it were, the Roman numeral of the county sheet. The different families of each county being then placed in numerical order, any particular sheet required can be at once selected. The town sheets, similarly endorsed, should also be rolled together. The small index or key maps of the county, parishes, and towns should be kept at hand, when a glance will suffice to show the number of any particular sheet that may be required.

In our national maps the hedges are delineated by a single line only, this line denoting the centre of the hedge, and to which the acreage of each field is calculated.

It has been objected that the actual acreages are not thus always shown, since, in practice, some hedges are included and some excluded in computing areas of fields; but the Ordnance Survey Department has nothing whatever to do with the boundaries of private property, and rests content with endeavouring to produce a perfect picture of the kingdom, such as would appear from a balloon exactly over every point of the same. This picture, in convenient sections, is on sale to the humblest farmer and to the smallest land-owner, as freely as it is to the wealthiest proprietor, and at a price astonishingly small.

France was long before us in the execution of her Cadastral Survey, but the maps of the same are not published, as ours are, for sale to the public, and thus that nation is deprived of almost all the immense benefits we enjoy. Without our national maps, giving, as they do, an accurate impartial plan of the whole of the kingdom on a fixed scale, with identical styles of drawing and with identical symbols, a proper system of land transfer and registration would be impossible, and on the final passing of the present Land Transfer Bill the importance of the national maps will become increasingly manifest. For the benefit of the public it may then seem desirable to permit the sales of local Ordnance sheets at the post-offices, and to exhibit in each post-office the index or key maps.

For those who wish to go more fully into the study of the subject, we may recommend the valuable work on "The Ordnance Survey of the United Kingdom," * by Lieut.-Colonel White, R.E., published last autumn,—a book which should be read and studied by every lover of his country.

* W. Blackwood & Sons. 1886.

"LES ARTISTES CÉLÈBRES."

UNDER this general title there has been appearing for some time a series of short biographical and critical notices of eminent artists of all ages, by various authors, written in French, and published in Paris, but on which the name of a London publishing house also appears. They form very pretty octavo volumes, in a vellum cover of artistic design, and the contents bear out the fair promise of the exterior, at all events as far as the literary portion of the work is concerned. The main facts in the lives of the artists dealt with are given in a readable form; but a higher value is given to these biographical essays by the admirable spirit of critical analysis of the art and the artist which pervades them. The illustrations are not all that could be desired, the slight and rather crude engravings serving rather as memoranda than as illustrations of some of the more celebrated works referred to. On the other hand, a good many reproductions of facsimile sketches, hitherto unpublished, are scattered about the pages, and these, which can be adequately represented by an inexpensive process, are of real interest.

The volumes, so far as we have at present from time to time received them, deal with the genius and works of Pheidias, Donatello (we name them in chronological order), Ligier Richier, Palissy, Callot, Rembrandt, Edelinck, Lamour, Reynolds (this is the last one which has appeared), Prud'hon, Delacroix, Decamps, Fortuny, and Regnault: the respective authors' names are given below.*

In regard to the great Athenian sculptor, M. Collignon remarks with truth that it is more easy to relate the legendary than the real history of Pheidias (the French writers still retain the spelling "Phidias," which has been nearly abandoned in Germany and England), and the essay is, in fact, in the main a critical analysis of his known work, accompanied by illustrations mostly taken from the British Museum treasures, and which are better executed and more worthy of their subject than is the case in some of the other volumes of the series. The author makes no attempt at restoration of the pediment sculptures in the illustrations, but gives illustrations of some cognate groups, such as a "dispute of Athene and Poseidon" from a vase found at Kertch, and coins representing statues of Athene, which may give the general reader a better idea of the probable original and complete form of the central group of the west front, and of the colossal statue in the interior of the temple, than he could get from descriptions alone. The general question of the arrangement and signification of the groups is too large a subject to go into a notice of a work which is only one of a series; M. Collignon devotes a good deal of space to it, and concurs with Mr. Waldstein in regarding the figure in the library of St. Mark at Venice, and of which a cast has been placed among the Elgin marbles in our Museum, as probably one of the west front figures of the Parthenon; at all events, as certainly the work of Pheidias. M. Collignon

* Les Artistes Célèbres:—
Donatello. Par Eugène Müntz, Conservateur de l'École des Beaux-Arts. 1885.
Henri Regnault. Par Roger Marx. 1886.
Decamps. Par Charles Clément. 1886.
Fortuny. Par Charles Yriarte, Inspecteur des Beaux-Arts. 1886.
Jean Lamour. Par Charles Cournault, Conservateur du Musée historique lorrain, à Nancy. 1886.
Jacques Callot. Par Marius Vachon. 1886.
Gérard Édelinck. Par le Vicomte Henri Delaborde, Secrétaire Perpétuel de l'Académie des Beaux-Arts. 1886.
Bernard Palissy. Par Philippe Burty, Inspecteur des Beaux-Arts. 1886.
Rembrandt. Par Émile Michel. 1886.
Phidias. Par Maxime Collignon, Professeur Suppléant à la Faculté des Lettres de Paris. 1886.
Prud'hon. Par Pierre Gauthiez, Ancien Élève de l'École Normale Supérieure, Bibliothèque de l'Arsenal. 1886.
Joshua Reynolds. Par Ernest Chesneau. 1887.
Eugène Delacroix. Par Eugène Veron, Directeur de *l'Art*. 1887.
Ligier Richier, Sculpteur lorrain du XVIe. siècle. Par Charles Cournault. 1887.
Paris: J. Rouam. London: Gilbert Wood & Co.

touches on the question, what was the precise part which Pheidias himself had in the execution of these two great series of sculptures. Personal execution of the whole with his own hand was, of course, out of the question. The French critic seems to incline to the opinion that Pheidias himself modelled the whole in clay, giving the execution in marble to various sculptors in his *atelier*; that unity of conception and feeling, with difference in handiwork, is the evidence given by the work preserved to us; and there is a certain distinction between the style of drapery in the different figures, which is larger and bolder in some, and more minute and broken in others. But in the main one's feeling is that since assistance must have been employed in producing the whole, the general unity of effect in the execution is marvellous, and is an indication of the extent to which Pheidias was able to impress his own style and feeling on his subordinates.

The life of Donatello, who may be called the Pheidias of the Early Renaissance, comes not unsuitably after that of the great Greek. To be sure, Donatello was an artist who lived in an incomplete or childlike period of art, while Pheidias represented a period of manhood; but Donatello's greatest work, the St. George, presents, as M. Müntz observes, a grand simplicity of pose "which would have enchanted the Greeks themselves," and which places the work intellectually in close relation with the finest Greek work in an æsthetic sense, while there is what may be termed a moral beauty about it of which the Greek mind had hardly a conception. In his numerous bas-reliefs, moreover, Donatello shows a close artistic relationship, though unknown to himself, with such work as the Parthenon frieze: there is the same low relief, the same severity of line, the same delicate perception of the conditions and capabilities of bas-relief, and we never see one of Donatello's works of this class without thinking of the Greeks, though here again we find a tenderness and holiness of sentiment to which Greek art presents no parallel, the feeling represented in such a word as "holy" having, indeed, as far as we have any evidence, no place or existence at all in Greek art and literature; some of the Greek grave reliefs, of which we said something recently, come nearest to it, though here the feeling is rather pensive than religious, in the post-Christian sense of the word.

Considerable interest attaches to the essays on Delacroix and Decamps, those two remarkable artists of the earlier part of the century, when French painting was in a more healthy and vigorous state than it can be said to be now. It is curious at the present moment to read that the works of Delacroix evoked the most violent hostility for a long time from critics and from the artists of the old school, on account of their revolutionary style and revolt from the classic models of the "École." The best-known works of Delacroix would be regarded by most critics now as quite within the most orthodox canons of art, but his biographer, M. Veron, evidently regards him as a somewhat erratic genius, since he draws a contrast between the character of his work and of his life, the violent and tragic character of his paintings and the calm and well-regulated conditions of his own existence. It appears, however, that Delacroix so far carried the enthusiasm of his artistic side into his life as to have been at all times a very effusive friend or admirer of the people he loved and the things he admired. His portrait, with what the French call a strongly-marked "meridional" character, accentuated by his tangled mass of dark hair, indicates this kind of nature. As far as his art was concerned, our own judgment would be that he was a remarkable instance of an artist essentially romantic in style and feeling, but working within the strict lines of artistic form and propriety, combining passion and emotion with a remarkable degree of artistic balance and self-control. His "Waterloo," of which a reduction from an etching is given, is an example of this. This is a work of great pathos; a dark hill-side, a wounded man, and two dead horses, that is all; it tells its tale with great effect, but there is no straining after the dramatic in it, nothing stagey or overdone. Among the works from which illustrations are given, and which are not much known, is his series of illustrations of "Faust," of which the scene of the death of *Valentine* is illustrated, and also the broad and powerful pen-sketch made for a title-page to the set. Among the illustrations of sketches, the finest in the book is the "Education of Achilles," a most vigorous design, representing the young Achilles astride on the back of the centaur, who is galloping away from the spectator, and pointing with his hand at some mark at which Achilles aims his arrow, the figures of Achilles and the centaur both with a consentaneous impulse and bend in the same direction, which gives wonderful force to the composition. Delacroix was at war with the Académie set, or rather they were at war with him, for most of his life, though he received a tardy election at last. In connexion with the subject of the Academy elections, the author relates a story about another artist, M. Rude, who was invited by two members, X. and Y., to apply for admission to the Académie. He was balloted out, and heard from X. that Y. had voted against him. He charged Y. with this on meeting him, saying he had learned it from X. "Well," was the reply, "X. did not vote for you either, for you had not a single vote,"—an interesting illustration of the ways of Academies.

Delacroix was born in April, 1798; his brilliant compeer, Decamps, about five years later, as he said himself, "on the third day of the third month of the third year of the century." The volume devoted to Decamps is disappointing in the selection of the illustrations, in which rather disproportionate place is given to his earlier satirical and caricature work, very clever in itself, but not the kind of thing we connect with the name of Decamps. Of his more serious works the selection does not seem very judicious; at any rate, we have seen finer things of Decamps' than any of which illustrations are given here, except perhaps the "Christ in the Prætorium," the original of which we have not had the good fortune to see, and of which the engraving given is a very poor one, but which appears to be a remarkable Rembrandtish kind of work, an energetic contrast of expression between the calm face of Christ and the various vulgar and mocking figures around, brutal both in attitude and expression. It is a pity that a good illustration of "The Patrol at Smyrna" (one of Sir Richard Wallace's pictures) was not given; it is certainly one of his most characteristic works. The illustration of "Christ Crossing the Lake of Genesareth," which is a well-executed one, gives a good idea of his special power in landscape; as also the smaller engraving "Paysage en Syrie," with its square masses of white buildings in the foreground. M. Clément comments on the manner in which Decamps used architecture in combination with landscape and figures in his paintings:—

"Ce mot d'architecture ne doit d'ailleurs pas être pris dans son sens ordinaire. L'architecture n'est pas là pour sa beauté, comme dans les vues de Canaletto, ou dans les paysages de Claude Lorrain; elle n'y est pas non plus pour servir de Théâtre à l'action, comme c'est le cas dans les peintures décoratives de l'école Vénitienne, et en particulier dans celles de Paul Véronese. C'est la muraille, grande, nue, muette, projetant son ombre mystérieuse sur les portions du tableau vivement et franchement éclairées. L'ombre portée, héritage des peintres Espagnols, pierre angulaire de la doctrine de Decamps, joue là tout son rôle. L'harmonie n'est pas détruite par les contrastes les plus violents; l'œil passe, presque sans transition et sans être blessé, de la lumière la plus ardente, la plus éclatante, à des ombres intenses, transparentes, et profondes. Les figures ses détachent dans les demiteintes par des tours de force de science et d'adresse. Ici le sujet importe peu à Decamps; une rue de village en Italie, une cour de ferme en France, un porche d'église avec une mendiante, quelques animaux sur un fumier, un intérieur de boutique à Smyrne ou à Beyrouth, tout lui sert à poursuivre cette lumière, ce protée, dans ses infinies modifications."

It is true also, in another sense, that "the subject mattered little to Decamps," since he was one of those peculiarly artistic artists, so to speak, to whom a subject is merely an opportunity for artistic effect, not for any story, still less for any moral. His fine head, of which a good portrait is given, expresses this completely; it is the head of the draughtsman, the man with an eye for effect in everything, but as far as possible from an artist with a theory or a mission. The military character in his physiognomy, visible in this portrait, is still more brought out in that capital group of the leading French artists of his period, half soldiers half painters, in Mr. Armstead's relief on the Albert Memorial.

Of another gifted artist, who was indeed, too unhappily for the country which has lost him, both painter and soldier, Henri Regnault, we have no space to say more than to direct the reader's attention to this sympathetic sketch of his life and works by M. Roger Marx. A good engraving is given of the bust of Regnault from the monument in the École des Beaux-Arts,—and what a head it is! The very ideal of intellectual manliness and vigour. A good many facsimiles of his studies are given; some admirable sketches of dogs, and a brilliant study for an illustration to De Musset's "Namouna." Perhaps the force and originality of Regnault's genius are best shown in his "Judith and Holofernes," which is such a contrast in its terrible realism to the conventional Judith of respectable painters. His "General Prim" is an ardent young man's piece of bravado; of tremendous spirit, but still bravado; and his "Execution in a Moorish Palace" we always regretted; it is too brutal; and if the Prussians had not cut short his life he would possibly have lived to think so himself.

Among the less famous subjects of these essays, the sketch of the Lorraine sculptor, Ligier Richier, is of considerable interest, and the small outline engravings of his works show, in many cases, great though rather naïve originality. The very best, perhaps, though in a sense rather painful, are the figures of the penitent and impenitent thief, from the Church of St. Pierre at Bar-le-duc: these, by the way, we observe are only "attributed" to him. He was born somewhere about 1500. The thin volume on Jean Lamour, by M. Cournault, gives a good many illustrations of his elegant Louis Quinze grilles, gates, and lanterns. M. Vachon gives some account of Callot, the master of grotesque, with a number of characteristic examples, including a facsimile of his large etching of the temptation of St. Antony (a subject after Callot's own heart), and another of the well-known print showing the Pont Neuf and the old tower of the Porte des Vesles, with a big basket let down from it like a gigantic spider at the end of his line. The life of Prud'hon, one of the cold and pretty classicists of the eighteenth century, has the merit of being better illustrated than some of the lives which would have been better worth good illustrations. Reynolds, described as "le plus célèbre, mais, à nos yeux du moins, non le plus illustre" of English painters, is treated of by M. Chesneau with a certain enthusiasm for many of his works; M. Chesneau, indeed, admits that his portraits taken *en masse* are a wonderful collection, but he accuses Reynolds of having almost always in his eye some ideal model, Murillo or some one else, rather than the sitter he had in reality before him. What the author means he illustrates rather well by instancing as an exception the "Lord Heathfield," where he thinks the artist was really carried away by patriotic admiration for the commander and for the occasion, and gave a truly unaffected and grand picture of a great commander, without affectation or pretence. Among the portraits of women he thinks Reynold's *chef d'œuvre* is "Nelly O'Brien," but he does not say which Nelly O'Brien. He winds up:—"En un mot, il s'exhale plus souvent des œuvres de Sir Joshua Reynolds une odeur d'atelier, d'huile, et de vernis, qu'un parfum de réalité." We can understand the grounds for this opinion, but we think it is pushed rather too far.*

* As a set-off against this, it is related in the Life of Delacroix that on first coming to England and seeing the works of English painters, he was so struck with the style of Constable that he forthwith almost repainted the picture he was then at work on, the "Massacre de Scio," in an effort to emulate the vigour and freedom of the English artist's technique.

illustrations given from Reynolds's works are mostly very poor, and do no justice to the originals.

Taken generally, however, these are a very interesting and valuable set of monographs, written with true critical perception, and forming very pleasant and thoughtful essays in artistic biography.

NOTES.

PROFESSOR MARSHALL, in a letter to the *Times* of Monday, proposes that, in order to lessen the danger to the audience from fire breaking out on the stage, the stage should be ventilated from the auditorium, and that a number of extractors should be placed over the roof of the stage portion of the building, openings below in this portion being kept closed, and thus a continual current should be drawn from the auditorium on to the stage. The whole object of this absurd and unpractical suggestion is to obviate the tendency of the fire to spread towards the auditorium, as an iron curtain, though useful, as Professor Marshall admits, may not be let down at once ; that is, some one may be stupid or may not do his duty. And so, for no better reason than this, the actors are all to breathe the air the audience have already breathed, and to have direct ventilation cut off from them, and the whole movement of the air is to be set up in such a direction as to militate against the acoustic properties of the house! Did it never occur to Professor Marshall that it is more difficult to make yourself heard against a current of air than speaking with it? or did he never hear that the securing of a ventilation current from the stage side towards the house (not from the stage area itself, but from that direction) is a decided help to the acoustic qualities of a theatre? Really between the nonsense that people write to the daily papers and the nonsense that has been sent to us (but which we, at any rate, know better than to waste type on), it seems as if most people had gone out of their minds on the subject of theatres, and had forgotten that one object of a theatre is that people should hear and see a play in it. One person writes to us to know why all theatres are not built entirely of concrete and iron, and with an iron floor and bearers for the stage. Let him try it, and see how actors and audience will like it, and how many letters will appear in the *Times* abusing architects for building theatres in which actors cannot make themselves heard. One of the few sensible and practical letters we have seen on the subject is that of Madame Marie Roze in the *Times* of Wednesday, suggesting that the first thing to be thought of is improving the state of things behind the scenes ; taking gaslights away from dangerous proximity to combustible materials, and making the attendants who have charge of lights and of hose criminally responsible if anything goes wrong through their neglect. Electric lighting (incandescent lights) behind the scenes is the most practical step towards safety from accidental conflagration of scenery, &c. ; and the general adoption of that system on the stage at all events, if not in the auditorium, would render theatres a great deal safer.

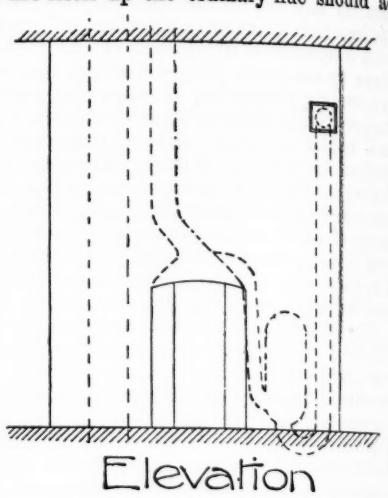
BAD as the public health is just now in London with so much scarlet and enteric fever prevailing, it should be a subject of heartfelt congratulation that the cholera has so far given us the go-by, although it still hangs about Southern Italy and Malta in an unpleasant manner. There was a most interesting discussion at the recent Vienna Sanitary Congress on the subject of quarantine, the uselessness of which was generally conceded, while England was specially singled out as the country which has taken the lead in demonstrating its inutility, by never imposing quarantine on people or things arriving from India, where most of the cholera has its source. The theory of contagion arising through water supply was disputed by Professor Gruber, while, on the other hand, Dr. Spatuzzi, of Naples, pointed out how that city had enjoyed comparative immunity ever since the new waterworks had been finished. Professor Pettenkofer lectured on the influences which, in his opinion, locality and season had upon the disease. Of course, entire immunity on such a subject could not be expected, though it was satisfactory to hear from some of the greatest Continental authorities of the day, that we in England are considered to be on the right tack in sound and logical treatment.

THE Local Authorities of Croydon are carrying on a systematic house-to-house sanitary inspection, evidently with all the beneficial results upon public health which have attended similar steps in some of the suburban districts. A pleasing feature of these inspections is that the owning and occupying public, recognising more and more the importance of such work, are putting forth now a helping instead of a frustrating hand to the sanitary officials. A large proportion of inhabitants no sooner hear that such a step is to be undertaken than they invite the authorities to examine the sanitary condition of their houses, and in very few cases has the surveyor to issue the threatening legal notice to remedy the discovered defects. It appears from the annual health report of Croydon that nearly 5,000 houses, large and small, have been visited during the year, and with only one or two exceptions have the owners failed to comply with the simple note of the Surveyor, pointing out the sanitary defects and the necessary remedies. The work appears to have already perceptibly decreased the death-rate. The death-rate for the seven weeks ending September 10th last was 14·15 per thousand of the population, notwithstanding that at this period of the year the rate of infant mortality is high in consequence of the hot weather. The death-rate for the year was 14·52 per thousand, though the mean rate for the preceding ten years was 16·72. The death-rate of Croydon is, according to the Registrar General's return, about 2 lower than the rate this year in the ring of suburbs round London, 3·28 lower than the smaller towns and country districts of London, and 4·78 lower than England and Wales generally. It may be added that in Croydon 461 of the better class of houses were inspected during the year, and 63 had defects in sanitary arrangements, such as would allow the escape of sewer gas into the house. As many as 229 were inspected at the special request of the owners ; of these 85 were free from defects, 79 had defects which permit of the escape of sewer gas ; and the others had only minor defects. 3,884 small houses or cottages were inspected : 884 of these were in an insanitary condition, but chiefly owing to dirt,—4,460 re-inspections were made to secure the execution of the necessary remedial work. It seems that the drainage defects were almost exclusively found in the older houses, and that in new properties, as a rule, the approved sanitary arrangements have been carried out.

THE small diagram appended shows the principle of a method of extract ventilation patented by Messrs. Young & Moss. The following is the inventors' description :—

"A grating is placed near the ceiling line, from which a pipe descends in the brickwork of the chimney-breast to the floor level, and then enters a small chamber or cylinder, through a syphon (all the apparatus being placed out of sight behind the firegrate) ; a short pipe is taken from this chamber, and communicates with the chimney-flue, terminating just above the fireplace opening ; the action of the draught (which is greatest at this point) on the end of this pipe, combined with the heating of the cylinder which is in contact with the fire, helps to draw rapidly off the vitiated air from the top of the room into the cylinder, and from thence into the chimney-flue. No reverse action is possible, the cylinder serving as an effectual trap and disconnector. In summer, in ordinary rooms the fireplace opening is better closed up, as by this means the draught up the flue is materially increased. Where the chimney-flues are defective, a gas jet may be placed within the cylinder."

We have always upheld that vitiated air should be extracted from the upper part of a residential apartment, to which it naturally gravitates (or levitates), and not be coaxed down again ; and this system has this recommendation ; and from personal inspection and testing we are satisfied that it does create a decided and pretty powerful extract draught even without the aid of the fire or of any other artificial heat near the upcast pipe. With the fire as a further assistance there would seem to be no possible doubt of its efficiency, unless the draught of the fire itself up the ordinary flue should act



as a pull the reverse way of the system ; this we have not tested, but we should think this result improbable. As to the function performed by the cylinder the inventors themselves do not seem quite clear, but they state as a fact that without the intervention of the cylinder it refuses to act, or is liable to do so, and that the result is the same if the upcast pipe is taken from the top instead of from the lower portion of the cylinder. The extract, of course, presupposes a corresponding area of inlet, but this is not dealt with as part of the patent. We inspected it under every disadvantage, with a temporary fixture and no artificial heat to stimulate the flow, and under those circumstances it is an efficient and pretty powerful extractor from the upper portion of the room, without any mechanical appliances.

A GOOD deal of excitement is being caused at Athens by the report of a discovery at Mantinea. The excavators there have come upon three large sculptured slabs, with a representation of the contest between Apollo and Marsyas. Marsyas appears with the Phrygian flute, his proper attribute ; Apollo with the lyre. The two are surrounded by the Muses, who are present as judges. The great interest of the slabs consists in the possibility of their identification with the designs in the pedestal of a statue seen and described by Pausanias (book viii.) in his account of his visit to Mantinea. He says :—"And the Mantineans have a double temple divided down the middle by a wall. In one part there is a statue by Alcamenes of Æsculapius ; the other is the shrine of Leto and her children. Praxiteles made the statues in the third generation after Alcamenes. On the basis of these there are *Muse and Marsyas playing on the flute.*" If Praxiteles made the statues, did he not also carve the pedestal? The reliefs are described as of the utmost beauty of execution. They are to be taken to the Central Museum at Athens. True, Pausanias only saw one Muse ; but then, perhaps, he only looked at one side of the pedestal

WE have not had an opportunity as yet of making an inspection of the Roman remains at Tockington Court Farm, near Bristol, but, if we accept the detailed account published in the *Bristol Times and Mirror* of the 1st of this month, the discovery is one of no little importance and interest. It is

odd to read that the first discovery of Roman remains on the farm, by a mason employed on some alterations in the buildings, was in 1884, and that, though the discovery was so far appreciated that it was decided to cover up the mosaic pavement discovered lest it should be injured by the frost (the discovery having been made in the winter), after this was done everything about it was forgotten till a few weeks ago Mr. Smith, the farmer tenant on this part of the estate, was reminded of it by coming on some other Roman remains while cutting a drain across his yard, and this led to a renewed investigation and to the finding of some large pieces of mosaic pavement, one of them, according to the Bristol journal before referred to, of about 14 ft. by 10 ft., as well as another piece 18 ft. square, and elsewhere a portion 50 ft. long by 10 ft. wide. The place has evidently been the site of a large Roman villa, but as to the precise value of the remains, of course, we will express no opinion without a special examination.

WE reviewed some time back (vol. lii., p. 491) at considerable length Drs. Furtwängler and Loeschke's last issue of Mykänische Thongefässe, and expressed at the time our warm adherence to their view that the Mycenæ antiquities generally were of autochthonic (Achæan) origin. This view we retain unshaken, but it is only fair to note that it has been recently very ably controverted by Drs. Dümmler and Studniczka. The German archæologists have a way of running and also fighting in couples, which denotes rather the magnitude of their undertakings than any individual inadequacy. The point stoutly maintained by these two last combatants is that the Mycenæ antiquities are *not* autochthonic, *not* Achæan, but in the main foreign and of Carian origin. The arguments to and fro are too complex to be summarised, but the paper which embodies them could not remain unnoted here, and deserves to be carefully read. It appears in the *Mittheilungen des Archäologischen Instituts Athen*, xii., Nos. 1 and 2.

THE Carpathio vases noted (p. 83) in Dr. Furtwängler's work just cited have been presented by Mr. Paton to the British Museum. The *Classical Review* for October,—a number which well maintains the high level of interest of the journal,—gives a list of further acquisitions. In addition to the above vases, Mr. Paton gives the Assarlik antiquities discussed in the *Hellenic Journal* (viii. 64-82), and three other vases of the Mycenæan type. After these the most interesting acquisitions are a lekythos (oil-flask) from Tarentum of peculiar technique, white on black with details in buff; a large hydria in the so-called Chalcidian style, with frieze of warriors, horsemen, &c.; and a curious bronze plaque plaque decorated in panels, each panel containing a pair of nude figures. This plaque is apparently a rough and probably late imitation of the sort of bronze work found at Olympia. The *Review* continues its full yet concise summaries of foreign Classical periodicals, literary and archæological.

THE series of notes by "A Foreign Artist and Author in England," which are in progress in the pages of the *Art Journal*, accompanied by many excellent sketches, deal this month with Chester, coming, therefore, rather *apropos*, just when such a discussion on the Walls of Chester is being carried on; though the coincidence appears to be quite accidental. The author (M. Villars, a Frenchman, we presume) does not go into questions of archæology, but deals with the artistic and picturesque aspects of the places he visits. The article this month includes a sketch on the Walls of Chester, and another on the Rows, both exceedingly faithful to the locality. Mr. Villars comments, with some excusable sharpness, on the fact that when inquiring in the city as to the existence of any art or archæological museum, he was sent to the little worthless collections in two of the old turrets on the walls which are miscalled museums, and that no one gave him any information of the existence of the recently-formed Museum and School of Art in Chester, of which he only heard from a friend a few days after his visit. M. Villars rather criticises, and we think with reason, the habit of erecting modern buildings in the Rows in direct imitation of the old half-timber houses; the intention he thinks is praiseworthy, and shows an appreciation of the picturesque element in the ancient structures, but he considers the contrast in tone and appearance between the old thing and the obviously modern imitation has a very unsatisfactory result. These articles in the *Art Journal* should be looked at by those who are interested in seeing how our towns and villages appear, both as regards architectural and human character (for there are plenty of capital figure sketches), in the eyes of an obviously clever and cultivated foreigner.

THE College Hall at Worcester, which has been lately restored under the care of Mr. Christian, was reopened on Monday last. Now serving for the purposes of the Cathedral, or King's, School, this fabric had been the Monastery refectory. Its upper portion dates from the fourteenth century, whilst the lower floor, with its undercroft, is two hundred years older. Henry VIII. gave to the Dean and Canons' charge a boys' school which would seem to have existed here concurrently with the original establishment of the see. According to Smith and Onslow's "History of the Diocese" (1883), this see dates from 680 A.D.,—Ethelrhed being then king of the Mercians,—when Bosel was consecrated first bishop. Bosel had for his church, in the old borderland of the Hwiccas, or Wiccians, that of St. Peter, founded by Saxulph, bishop of Lichfield. Wolstan, twenty-fifth bishop, rebuilt the church in 1030. Amongst its more celebrated bishops in early days were Oswald and Dunstan. The refectory stands against the southern side of the cloisters, and has latterly been used for the Festivals of the Three Choirs. During the course of its restoration a staircase leading up to the roof and some blocked-up windows were discovered. The Ecclesiastical Commissioners meet the expense of the new works, which exceeds 5,000*l*.

THE *Art Journal* announces that its "Art Annual" for 1887 will be devoted to the life and work of J. L. E. Meissonier, "whose pictures fetch such fabulous prices." We are very glad they have chosen so good a subject, but why tag it with the statement about "fabulous prices"? That has certainly nothing to do with the artistic value of Meissonier's work, nor does that remarkable artist need any such *ad captandum* statement to draw attention to his works. The literary portion of the work is to be done by Mr. Lionel Robinson. The principal illustration will be a photogravure of "La Rixe," one of the most popular and one of the cleverest of the artist's works, as a representation of vigorous action, though not one of those in which his peculiar genius is shown in its finest aspect.

THE *Indian Engineer* for September 3rd gives a description and plans and sections of the new swimming-bath in process of construction at Calcutta. The bath itself is 100 ft. by 35 ft., enclosed in an oblong building with an iron roof, with the necessary offices, waiting-rooms, &c., at the entrance end, and dressing boxes ranged along one side of the bath. The retaining walls of the bath are stepped from 2 ft. thick at the top to 4 ft. 6 in. at the bottom, and under the bath is a bed of concrete 2 ft. thick. The retaining walls, as far as we can gather from the description, are of brick, these and the bottom of the bath being lined with ½ in. Portland cement. The edges of the platform round the bath are to be faced with stone. The general design of the bath is by Mr. W. B. Gwyther, and the contract was taken by Messrs. Mackintosh, Burn, & Co., for 35,000 rupees. The exterior design is about as ugly and devoid of architectural feeling as anything well could be, but they are used to that in India, that paradise of engineer-architects: it would appear that practically the work has been well carried out. The proposal to empty one fifth of the water every day, so that it should be completely changed once in five days, seems most inadequate: a swimming-bath should either have a current running through it, or should be completely emptied and refilled every day, at all events if it is in full use. Possibly considerations of water supply have affected this portion of the arrangements.

THE Government, we are informed, has sanctioned the definitive adoption of the iron process, invented and patented by Mr. Conder, M. Inst. C.E., at Chichester Barracks, and the War Department has taken over the supervision of the works, which have been conducted by Mr. Conder for the last fifteen months, under the order of the Secretary of State for War. This looks as if experience had proved it to be a practical success, and we congratulate Mr. Conder thereon.

MR. ALFRED GREIG, of Leeds, has designed a new form of traction engine for tramways, which is intended to dispense with the heavy wear and tear consequent upon the working parts of such engines being close to the road surface, and, therefore, always exposed to either dust or mud, which rapidly grinds away the working surfaces. In Mr. Greig's engine the cylinders and working parts are mounted, traction engine principle, on the top of the boiler, instead of underneath, as we find it in the tramway engines now in use. The engine is 11 ft. 6 in. long, 5 ft. 8 in. wide, and 9 ft. 6in. high, and has a boiler of the locomotive type, burning ordinary gas coke, and working at a pressure of 180 lb. per square inch. There are two cylinders, each 5½ in. in diameter by 10-in. stroke, and the power is transmitted through spur gearing to the driving-wheels, as in ordinary steam traction engines. It is taken from a pinion on the crank shaft to an intermediate wheel, which gears into other wheels, one on each of the driving-axles, thus dispensing with coupling rods. The engine is carried on spring wheels, which save the wear and tear of sliding axle-boxes and improve the running. The exhaust steam is conducted to an air-condenser placed above the engine, and over the tubes of which cold air is drawn by means of a Blackman air-propeller, driven by a small auxiliary engine. This fan, which is placed in the roof over the boiler-flue, for there is no chimney-stack, also creates the necessary draught for maintaining steam. The engine is fitted with all the Board of Trade requirements, including an automatic steam brake, which shuts off steam directly the engine reaches a speed of nine miles an hour. The new engine, with which a very satisfactory trial run was made recently on the West Brighton and Shoreham Tramways, about the worst road in the kingdom for locomotive work, appears to be eminently suited for working tramways by steam efficiently and economically. It has been constructed by Messrs. Aveling & Porter, Rochester.

WE have received from the publishers of *Church Bells* an "Album of Notable Midland Churches," containing illustrations and descriptions of a good many churches, some of which are not very well known. The engravings are unfortunately poor in style, but they seem to aim at correctness, and with the descriptions the Album may be regarded as a useful memorandum of some churches that are worth keeping in mind.

WE regret very much to learn that Mr. Beresford Hope is dangerously ill, at his residence at Bedgebury, in Kent.

FROM the letters of the special correspondent of the *Times* at Bolton it appears that not only is the institution of the "picket" in full operation, but that tradesmen in the neighbourhood find it, or think it, necessary to write letters to the local papers to contradict any rumour that they have supplied provisions or other necessaries for the imported workmen. It appears that numbers of non-society

workmen who would be glad of work are struggling in vain to break through the cordon of pickets to get to the work which is offered them, and those who do get in have to be provided with food and lodging, as they cannot safely go out again. There can be no two words about such a system. A man who refuses to work except under certain conditions may be right, or may be mistaken, he may even be unreasonable, but we cannot say more than that: but a man who endeavours forcibly to prevent fellow men in search of work from doing work which he himself will not do on the same terms is a selfish scoundrel, and that is the plain English of the matter.

THE TRAINING OF AN ARCHITECT.

On Wednesday evening Professor Roger Smith gave the introductory lecture to the architectural classes at University College, the subject being "Education, Cultivation, and Examination." After a general review of the subject, in the course of which he deprecated the frequent abuse of examination and the popular cramming system of the day, while expressing an opinion that the examinations for Associateship of the Institute of Architects were such as could not well be passed by mere cramming, the Professor continued:—

Having now considered general education, cultivation, and examination, I propose to pass to these subjects as they specially affect ourselves as students of architecture; and in approaching this division of the subject, I desire emphatically to point out that every architect ought to be a cultivated as well as an educated man. I shall have to point out later on that not a few of the studies and pursuits which to men in other stations are simply aids to cultivation, form part of the architect's special professional training; but apart from that, if he be not a man of cultivation, he will not do his duty well, and he will not properly occupy the position which a member of so liberal and responsible a profession ought to hold in society. You may perhaps remember that I said early in this lecture that "the object of education is to equip the student for the part he has to play on the stage of the world." If I can sketch for you the part which the architect should be prepared to play you will more readily comprehend the training he requires. Let us examine "the architect's part." There are three directions in which knowledge, skill, and experience are expected of him,—(1) As to buildings and structure; (2) As to men and affairs; (3) As to drawing and art. And I propose to take these in their order.

I. An architect ought to be familiar with *buildings and structure*. He ought to know all sorts of buildings, their various purposes, and how those purposes are provided for,—all that makes them suitable or unsuitable for use, and for any emergencies for which they ought to be prepared. He ought to know structure also,—that is to say, all the materials of which buildings are usually made, their appearance, qualities, defects,—the marks of goodness or badness in them, and the modes in which they are wrought, the work they will have to do in the structure, and their fitness for it. He ought to understand the sites and surroundings of buildings,—drainage and sanitation, fittings and appliances, and should have mastered the scientific principles upon which such things as heating, ventilation, lightning conductors, and cooking apparatus should be arranged, as well as their practical details. He has to understand the decay and disruption of buildings, and the risks of decay and accident that beset them, and how to guard against such risks. Again, an architect ought to know something about the history of buildings, and the most important structures in the world. He ought to know the artistic principles upon which good buildings have been designed, and the forms, mouldings, enrichments, and features which have been to the great artists in architecture what the colours on his palette are to the painter. And he ought to know by personal knowledge and experience, by measuring and drawing out in some cases, and by sketching and noting in others, a considerable amount of good architecture and good ornament, some of which ought to be from other countries than our own. And with some of this architecture he ought to be familiarly, nay, intimately, acquainted. Further, he requires to be at home upon buildings in course of construction, to foresee what is likely to be successful or otherwise, whether in arrangement, construction, or design; and to be able to correct defects and prevent mistakes, alike of design and of construction, before it is too late.

II. Again, the architect is required to know *men and affairs* as well as building. You will come to find, as you advance in life, that in every professional calling, as, indeed, in every important position in life, a knowledge of men is the most valuable of all acquisitions. Even the solitary student, or the lonely landscape-painter, works for others, and if he succeeds it is either because his mind is so in harmony with the thoughts of his time that he involuntarily produces what others delight in, or else because his powers of calculation and observation enable him to take the measure, so to speak, of the men of his generation, and cleverly to produce (possibly without sympathy) some work sufficiently in harmony with the time to please them. Far more is it the case with ourselves whose work is from first to last done in contact with our fellow creatures, that a knowledge of what men like and think and do is essential to success. The inception of any architectural undertaking grows out of the desire of other people to erect a building. The material carrying of it out is done by other hands than the architect's under the control of another head, often fuller of the desire to make money than to make a building; and the whole undertaking is beset by difficulties, emergencies, and varied transactions, in which the architect has to unravel one tangled skein after another with different people. In short, from that early stage in his career, when an architect has to establish his position, make a connexion, and inspire confidence sufficient to induce persons to put their work into his hands, to the close of the transaction, when the last instalment of his own fees is paid him, he has need of tact, resource, a command of temper, presence of mind, good common sense, the ability to write a clear letter, and, in short, the qualities, natural and acquired, which enable a man to get on well with his fellow-men. All this must be combined with a knowledge of affairs. All this intercourse with other people rises out of matters that have relation to the buildings, or the site for them, or the materials of them, or the uses they are to be put to, the laws affecting them, or the customs, or the prejudices, or conflicting interests of the folk who have to deal with them. Now, in every one of these things the architect or chief builder, if he is to be chief, must be sufficiently posted up to take the lead. He must be familiar with such of the forms of transacting business, correspondence, accounts, vouchers, &c., as are used in building affairs, and such laws, customs, rights, as are incidents of or affect his work, and, in addition, with an infinite number of things that bear on it only indirectly. Estimates, accounts, the value of the things that are used in making buildings, the value of buildings themselves, and of the land they stand on. Road-making, repairs, light and air, the statute and common law as affecting buildings and property,—on all these affairs he is expected to be able to give advice,—and sound advice. He ought to know something about every use that a building can be put to, and though so much is almost unattainable, yet he ought to be constantly approaching to such a state of unusual knowledge of what goes on under all roofs the longer he lives.

III. *Drawing and Art.*—We build our buildings on paper to an extent never hitherto practised, but rendered apparently necessary by the modern contract system; but more than this, we study with the pencil when we examine existing work. The pencil aids to develop and fix our ideas when we are designing; with the pencil we make our intentions clear to our clients, and at a later period to the surveyors who prepare the estimate, and the artisans who carry out the work. Drawing, then, is a most essential,—the most essential of acquisitions for an architect. The best draughtsman may possibly never make an architect, though I do not think such a result need often occur; but no architect can hope to succeed at the present time who does not draw well, and is not familiar with all that ought to be and habitually is done in drawing out architectural designs, plans, and details, from first to last. Familiarity with plans is *not* a substitute for familiarity with building, but it is an admirable introduction to buildings, and the best possible aid to the mastering of them. The draughtsmanship that is necessary will extend beyond familiarity with plan-drawing. A good draughtsman must have so far mastered the use of the instruments as to be able to *think* through his bow pencil or his straight-edge, and he must be able to draw all the ornament in his buildings, including representations of the human figure, that his drawings shall be serviceable guides to the workmen. He ought to have mastered perspective, and to be at home to some extent in colour. Finally, in the use of these means he should have the feeling and inspiration of the artist, and he should have sympathy with and a knowledge of other walks of art as well as his own. Art which I have named last, on the principle on which the most famous performer is placed at the foot of a play-bill ("*and* Adelina Patti," for example) is that which determines the level at which our architect shall work. If he can be the artist in feeling and training, and in what he designs, his work may be noble architecture, and certainly will be good. Being an artist, be it remembered, relates to everything that developes a sense of beauty in form, line, and colour, and in all the allied parts as well as in our own. I need hardly point out that this considerable range of knowledge and experience will take years to acquire,—in fact, it is the work of a lifetime; but what we are concerned with is that approach to it which justifies a beginning. This ideal portrait is not often, however,—even if time enough be taken,—carried out symmetrically and completely. Opportunity enables a man to accumulate experience, knowledge, and skill in one direction. The lack of opportunity, or of will, or taste, cramps him in another; and so it comes to pass that most men are better in one walk of this profession than in another,—fortunate if they are able to find that class of work for which they are most fit. In passing I ought to point out that more than one of the matters that figured in our enumeration of the cultivated man's acquisitions or methods are almost essential to the architect. This is especially the case with his drawing and his cultivation of the fine arts. He almost alone of all professional men should, as a matter of course, include foreign travel as a part of his training. He also, in common with all professional men, should cultivate his mind and powers by Bacon's method of reading, writing, and social intercourse. In short, he should be a cultivated man. I now turn to the standard which has been set up by the Royal Institute of British Architects as marking what they consider should be the attainments of a young architect before he is admitted as an Associate of that body. This standard we find set forth in the programme of the examination and in the specimen examination papers published, and though my statement is in less detail than the series of subjects of examination, you will find that those subjects group themselves under my broader headings perfectly well. My first heading is "Buildings." To the subjects which I embraced under this head the programme allots 400 out of the total of 700 marks, divided as under:—History of architecture, 100; mouldings, features, and ornaments, 100; sanitary science, strength of materials, and shoring, 100; materials and construction, 100. You see that the largest demands, even when a deduction, which I shall come to directly, has been allowed, are made under this head. This is partly on account of the fundamental importance of a knowledge of buildings, and partly because fair opportunities for acquiring that knowledge are open to you in your student days. My second head was "Men and Affairs." This comprises two heads in the examination programme, between which 100 marks are allotted. They are:—Specifications and estimating, 75; professional practice, 25. The first of these two subjects most students can easily acquire, and skill in it can be readily tested by examinations; but much of the knowledge comprised under the head of professional practice cannot be acquired till later in life, so but few marks are allotted to the subject; moreover, the skill, tact, self-possession, and judgment needed for the transaction of business are not matters in which a candidate can be directly examined; though, as far as they come out in his *viva voce* examination, they will be sure to have a share in examining the result. My third head, "Drawing and Art," is directly

represented by one heading only, Plan, Section, and Elevation, to which 200 marks are allotted. Of course a proportion which the programme does not disclose of the marks allotted to the first group of subjects will be given to the sketches with which the answers are to be illustrated, and, as far as they go, these marks will increase the proportion devoted to drawing and art at the expense of those devoted to knowledge of buildings; but it is not likely that this could ever take place to so great an extent as to equalise the two. This examination grows, as you know, out of the voluntary examination, which acted as a pioneer to prepare the way. I had the honour of having some share in preparing the preliminaries of that examination, and am, alas! the only survivor of the five who acted as examiners and moderators on the first occasion, the others being Scott, Digby Wyatt, Ashpitel, and John Papworth. Some of those who organised and subsequently recast the scheme still remain,—among them, I am happy to say, my immediate predecessor in this class, Professor Hayter Lewis, to whose initiation as honorary secretary to the Institute, more than to the action of any other person, we owe it that to-day we have an entrance examination for Associates of the Institute. The advantages which it was considered that students would obtain were, first, that the programme would make it clear what directions in the opinion of persons qualified to judge an architect's studies and his preparation for the serious work of his profession ought to take; and, secondly, that the examination itself would establish a standard of attainment which it is not unreasonable to expect that every student with the usual means of study at command shall reach before he looks upon himself as qualified to practise. The Institute by adopting this examination as the door through which every Associate must enter, had in one sense doubled the value of it, for it had added a double stimulus to work. Passing has always been a distinction; but now failure to pass entails a very serious professional disability. Of all things I should deprecate, —and I think in this I should speak the feelings of the examiners and council generally,—I should deprecate this examination being looked upon, or coming at any future day to be looked upon, as an arbitrary test. It is intended to be, and I think is so worked by the Board who undertake it, as really to be a test of qualification. That is to say, a man is not held fit to be admitted to the Institute because he has passed the examinations, but because he has fitted himself to perform the duties of an architect, and the examiners will direct their questions so as to satisfy themselves of this fact only. Whenever, or if ever, the examination fails to keep up its character in this respect, if it admits what are called catch-questions, and sinks to the level, for example, of the Civil Service examinations, where a man is passed as a consequence of his having temporarily worked up certain subjects, it will fail of its real object. Consider, then, that your duty really is to prepare yourselves for practice, and that this examination is an incident in such preparation. And do not consider that you are to prepare yourselves for examination, and that if you can worry through you are sure to be right as far as fitness for your professional life goes. If we have now arrived at some clear understanding of what you require to prepare you for practice, the only questions which it remains for me to deal with are first, the broad question of how generally you are to obtain it, and the narrower one of how much of it you can get here from me? I am not going to delay you in order at any length to examine any scheme of architectural education not at present in actual force, and within reach. Such an examination you will find in the reports in the professional papers of the conference on education held in May last. I should, however, like to refer, before I pass from the subject, to the programme of instruction in several of the American colleges, which, through the kindness of Mr. Cates, have been brought under the notice of many architects. In these programmes a course of scientific instruction is in each case provided, lasting several years, and taking in its turn history and draughtsmanship; but without enough attempt, so far as I can see, at securing for the student any familiarity with buildings. I trust that if these are seriously examined as precedents, it will be by the help of the light thrown upon them by observations from the pen of Mr. Wace appended to them.

The American schemes appear to me too theoretical, not artistic enough, and in other ways not suited as models for an English course of architecture, should such a course come to be established, as is very probable. It will be even less necessary to raise the question of technical education for artisans, which is one of the most important ones of the present day. The subject before us to-night is, it is true, to a great extent, a branch of technical education, for it relates to the education of the architect for the exercise of his art, and time will not serve us to travel outside its limits. I propose to pass at once now to the question of how, with the opportunities that London at present offers, you can be educated for your profession? Even that stage of preparation which the Institute examination marks cannot be reached without *time*. To become a great architect is the labour of half a lifetime. We have, however, had great architects in this country, and have them now; so it is clear that whether our appliances and methods are the very best or not, at least they *can* suffice. I once heard one of the greatest of modern water-colourists exclaim, before a gathering of artists, "It is not the water in the brush, but the spirit in the man that makes a painter in water-colours!" This is quite true; and if we take any great architect,—say, Sir Charles Barry,—it was the spirit in the man that made him what he was; still, the water-colourist does have water in his brush, and Barry reached his eminence by some path. Let us turn to the published memoir of him, and ask what was that path? Pupilage for a long term, travel for a long term, and then continuous effort,—first to obtain, and then to carry out, responsible practice,—is the answer that we shall obtain. Now, that simple programme will form the outline of the only course at present open to the architectural student of the present day, and I recommend both parts of it to your cordial adoption, not necessarily as the best possible programme,—on that I offer no opinion here,—but as the best possible in London in the year 1887; and I will endeavour to show how much pupilage and travel themselves can do for you, and what can be done to fill out, add to, and supplement these two cardinal elements. With or without sound preliminary training, let us suppose that the student begins his career as a pupil. The life of Barry tells us that he was articled for and worked out seven years. This is not perhaps too long for a man to work at the drawing-board, but it is too long to be in one place. The term now fashionable is three years, which is too short, and I believe that, as a rule, four years is a very useful term, and that then most men had better change, and spend two other years seeing the practice of other offices as assistants, and, as a rule, as paid assistants. I have not much to suggest to pupils; but I ought to point out that what is really intended to be done for them is not to teach them as they were taught at school, but *to give them a chance*. In consideration of the premium he has paid, a young man who for a long time is more of a hindrance than a help is tolerated in a place where the work would go on better without him, and it is an understood thing that he is to be allowed opportunities of learning if he will use them. This,—though it may not sound a very precious privilege,—is really of far more value than most young men have the remotest idea of, and the great danger, especially for students who come straight from school and have not had the training in self-culture which college affords is that the opportunities may not be properly made use of. Let me urge on the notice of any pupils who may hear me, half a dozen or so friendly hints:—first, to consider no trifle beneath their notice; secondly, to recognise that to acquire habits of punctuality, order, the mode of conducting simple affairs, endorsing letters, conveying messages, &c., are all essential to their success in after-life as business men; thirdly, to do everything entrusted to them as well as they can, but as far as possible to secure the difficult jobs and pass the easy ones on to some one else; fourthly, to let nothing pass that they do not understand without extorting an explanation from some one; fifthly, to visit the buildings on hand and the builders' workshops whenever there is a chance; lastly, to make sketches and notes of every possible thing, insignificant or otherwise. A pupil who will spend his four years in the practice of this line of conduct will leave the office a good deal nearer being an architect than he entered it. It is, perhaps, right to add that though I may have given what does not seem a very brilliant account of pupilage, and though I am about to show that it must be supplemented somehow, I do not think that what it supplies can be got elsewhere. So practical a pursuit as an architect's business can, I think, only be learnt by taking part in the actual conduct of it; and though many pupils would do better had they spent some time in preparatory study before being articled, I see no reasonable prospect of any system being introduced to supersede pupilage without great disadvantage. In the pupil's career I include any subsequent time spent in somewhat similar work, though under the name of an improver or assistant. A still more useful addition to a pupil's course is a time spent in a position somewhat analogous to that of a clerk of works, or as resident assistant to a clerk of works, or as resident draughtsman on some building. Naturally, this is a rare chance. Very few pupils of five or six years' standing, if any, are really fit to be of much service as clerks of works; but if they can in any capacity spend some time on a building, they will find opportunities for acquiring practical knowledge that are invaluable. Let us now inquire what advantage the student ought to be able to reap from pupilage, and from that kind of extension of it which I have sketched. First, as to buildings, our first head. He will learn little or nothing of their history, and in the ordinary course he will see little or nothing of old buildings, but he will have opportunities in a disjointed way of acquiring familiarity with many of the features, ornaments, mouldings, decorations, and with the general design of the buildings in course of erection by the architect to whom he is articled, and not unfrequently with the design of some ancient buildings, as shown in prints, books, photographs, and sketches,—Classic, Gothic, or Renaissance, according to the proclivities of his master. He ought to have the opportunity of acquiring a pretty thorough knowledge of ordinary construction, and in some cases of special construction, and of learning how to specify and how to make approximate estimates. He will be sure to have opportunities of learning something about materials; but probably most of them will be wasted unless he gains elsewhere some general systematic familiarity with the subject theoretically. He may get some acquaintance with the appearance of buildings in course of erection, and of course it may happen that he may come into contact with old buildings in course of decay; but this experience is generally reserved for later days. Passing to my second head "Familiarity with Men and Affairs." In a large office a pupil rarely has anything to do with men and not much with business. In a small office, the pupil often has to see people, and to devote part of his time to letter writing or accounts and writing out reports, and from all of which engagements he will by degrees learn that valuable familiarity with men and things which we term business habits. If he is at all observant and does his best to make himself useful, and especially if he writes a good hand,—a valuable, and, I regret to add, a rare acquisition,—ought to become perfectly familiar with all the ordinary business documents that an architect has to do with, and so when he enters upon practice this part of his office routine will be at his fingers' ends. Much of the proper dealing with *men* must, however, be learned from his actual responsible contact with affairs in real life. My third head was "Drawing and Art." If a pupil goes into an office properly prepared, or, at least, well up in drawing the figure, and he has fair abilities, four years ought to make him at least a fair draughtsman. If in four years he thoroughly merits the praise of being a really good draughtsman, he has done well. The routine of preparing drawings from first to last should be familiar to him, and he, generally speaking, will have had an opportunity of making himself acquainted with perspective. Making designs is another matter; it depends upon other things than office work, and will not be learned in the office. As to art, as applied to buildings, or as seen in painting and sculpture, if the student is articled to an artist, and artistic work is being done during his term, he ought to gain much artistic training from office work. If (as is often the case) there is little to teach him fine art going on, he has to look for it elsewhere, and he need not look in vain, for many of the best artists in our profession have been brought up in offices where they had little chance of learn-

ing the fine art of architecture, though fortunately for them the technical art of building was learnable thoroughly. If I am correct in the view I have taken, it seems that the student unavoidably, and in the nature of things, is to look elsewhere than to the architect to whom he is articled and the associates with whom he will work in the office for preliminary preparation and for several important parts of his training. As for preliminary preparation, it is impossible for an architect to have too good an education, and I wish that every student were a graduate of one of our Universities; but, at any rate, I hope that most will have obtained a thorough English training, with a good knowledge of, at least, one modern language, a fair amount of mathematics, and the elements of some of the natural sciences; that is to say, physics, and, if possible, geology and chemistry; and last, but not least, that he will be well grounded in drawing. It is seldom that a youth or his friends select architecture for his profession without his having some amount of skill in drawing; but it has rarely been carried far enough. The student should be able to draw the human figure from the antique fairly well, and ought to know something of perspective and landscape. If he has not advanced at least as far as this, it is better to spend some months at a drawing-school before entering an office at all. Some actual work in a joiner's shop is not a bad preparation for pupilage. Whether any part of this, which I call preliminary work, has to be taken up in addition or not, the following portions of the equipment I sketched a short time back must, it seems, be got elsewhere than at the office: As to Buildings, their history; much of their construction and materials, and science, and the superintendence of work. The study of existing buildings. As to Drawing and Art, design and the refinements of draughtsmanship, and fine art generally. As to Men and Affairs, all those parts of the conduct of practice which lie beyond ordinary routine, including the law of buildings. The most important of these is the study of erecting buildings, and I wish with all great emphasis to lay down distinctly the truth,—sometimes I fear forgotten,—that to study the buildings you must go to them. The knowledge about buildings which lectures, books, photographs, and prints convey, is not a knowledge of buildings. You must see, study, and sketch them. There is very great advantage in a student, after a sufficient number of years have been spent in preparing himself, taking a tour, an extended tour, and a continuous tour through as many of the regions of Europe that are architecturally rich as he can, and if it can be extended into the East so much the better. This sort of tour has, I think, fallen in the estimation of students partly because the facilities for short trips are now so good, partly, I think, because many men during the last twenty-five years have practised little else than English Gothic, and such have been contented to limit their studies to this country, with perhaps a visit or two to France, Belgium, and Germany. But the star of English Gothic is setting, and the student cannot afford to neglect Classic, Renaissance, Romanesque, and Byzantine examples, such as he must cross the Channel to study: and for good reasons which I cannot stop to go into now, six separate trips of a month each do not do one half, probably less than half, the good that one tour of six months will do. Some building or buildings must at some time be examined very thoroughly. I am disposed to think that the balance of advantage is on the side of comparatively few good examples most thoroughly investigated rather than a large number less completely studied. Each building selected should be measured and drawn out in detail, so that the drawing would suffice to re-erect the building, or the parts of it which are of architectural merit, if it were burnt. It is obviously convenient in many cases to select some English building for this kind of analysis. Of course, a much larger number of buildings must in addition be less thoroughly treated. Though I have urged the long Contiuental tour as desirable,—and, let me add, most enjoyable,—it must not be supposed that short periods of study of buildings near home are not great helps. Never lose a chance of visiting, examining, and drawing good work, old or new. There is a certain amount of very good old Gothic, and fairly good old Renaissance, to be met with in London, and the best modern work of both sorts here is quite as well worth study as the old, only let it be the best. London also presents opportunities of studies in museums, of which, I think, few architectural students avail themselves as they might. We have antique work in the British Museum. We have an unrivalled collection of Decorative work, and Renaissance, and Oriental specimens at the South Kensington Museum, where there is also a magnificent series of casts, including many that would form excellent studies for architects. At the Architectural Museum there is a rich collection of Mediæval architecture; and at the Crystal Palace a series of casts and models of every age, the Renaissance, Byzantine, and Gothic being very good indeed. In all these places students who want to work can get leave to draw with very little difficulty. I now turn to the other points in which the student of architecture requires help. First, I am bound, I think, to refer to that provision which this college has made for assisting him, a provision of which I am proud to say that in the past a large number of men now successfully pursuing the practice, and in later years numbers of men whom I hope to see successful in life, have availed themselves. Those portions of your necessary studies in which you can be helped by attending classes here are,—(1) The history of buildings. This, with an examination into their features, details, and the growth and metamorphoses of architectural styles, forms the subject of the A, or art course here. I do not pretend for a moment to have time, in a session of thirty evenings, or the ability, to tell the students all they require to know; but I claim that the course here gives a systematic and connected view of this history of ancient and modern architecture. I endeavour to make the subject interesting, and prefer to content myself with only taking up as much as can be done thoroughly, rather than to attempt to get over too much ground. There is a magnificent series of diagrams, which are lent to students to work from as well as hung up in the room, and I have endeavoured, with a success of which I confess I am a little proud, to induce the students themselves to draw illustrations of the subjects of the lectures.

The Materials and the Construction of buildings from the subject of course B, and here, as in the history of architecture as an art, I am far, indeed, from attempting to cover the whole field; but the course is consecutive, systematic, and thorough; it takes up all the principal building materials, and how to use them, and I endeavour to make sure work as we go. From both these courses I believe students derive the advantage that they have planted in their minds a sufficiently connected view of the art in the one case, and of construction in the other, for them to be able to appreciate the meaning of every fact which comes under their notice either in their reading or sketching, or on buildings; in other words, that beyond direct gains they are enabled to get advantage from many other sources of information which would otherwise be of less service. I desire to state very plainly that these courses are not so much directed to enable students to pass the examination at Conduit-street as to give them a real help in their education as architects; but I believe that in this way they will more efficiently aid those who are going in for these examinations than if I attempted to shape them exactly to fit the course of the question papers. I think, too, the final examination at the end of the term, and an intermediate one, which it is usual to hold, are of great service to those who are preparing for the Institute examination, by enabling them to see how much they are able to accomplish in answering a previously unseen paper of questions on architecture within a fixed period, and quite without assistance. I am sometimes asked if these courses give enough information to enable students to pass these divisions of the examination to which they respectively relate. My answer is, that it depends upon the student. If he simply attends and takes some notes, and does nothing else,—Certainly not. If he attends, and gives time and study at home to the subject, and tries to make all that he heard in the class-room his own, and then to pursue the lines suggested for further private reading at points where want of time obliges one to curtail part of a subject,—Yes. Not, however, forgetting that personal familiarity with some architectural buildings is absolutely essential to success in the examination. Course C proposes to give such information on the general conduct of building operations and architectural practice, and on some of the laws respecting buildings, as is most needed by men beginning practice, including some notice of the supervision of building works, and the decay of buildings, and the measures to be taken to secure dangerous and ruinous structures. Here, again, I think that by giving what is most serviceable to the young architect, I am doing my best for him in his preparation for his examination. Here the work of this college stops; but I have little hesitation in saying that it will help you in the departments to which it is directed to master your subjects more thoroughly than by solitary study you easily can, and that what you will learn in this room is adapted to form the groundwork upon which your own further work may usefully stand. I regret that time warns me that I must condense as far as possible what remains for me to say, and give you bare references in place of stating matters at length. Before leaving this college I must point out that some of the sciences bearing upon architecture can be well studied here, and that the Slade school affords excellent means of instruction in drawing the figure, though in neither case are the courses specially arranged for architects. Some particulars of these will be found at the foot of the prospectus of my lectures. At King's College Professor Kerr gives a course of lectures on the Arts of Construction. His ability and his long experience as a public lecturer are too well known for it to be requisite that I should say more to point out the value of the course. The most important subject remaining, Architectural Design, is to be learned best at the Royal Academy. One must be a good draughtsman to get in; but here not only is good drawing made better under the eye of that accomplished architect and teacher, Mr. Phené Spiers, but design is practised under the personal direction of the very first architects of the day, those I mean who have the honour of being members of the Academy. No opportunity so good as this exists, and no better opportunity well could be devised for students to acquire skill in design; and quite apart from the medals and prizes, this is enough to repay you for any trouble taken in obtaining admission. Next, I must refer to the Architectural Association and its work, a subject so considerable that I cannot do more than glance at it on general terms. A students' mutual improvement society, numbering about 1,000 members, with a library and at least a dozen classes and courses of lectures, and its own travelling studentship and series of valuable prizes, it is an organisation of great importance and with vast possibilities for good. I hope you will all belong to it, for from it individual portions of your architectural equipment can be well obtained. It is sometimes said that there are imperfections connected with the scheme of the Association, the most serious being that the work is to a certain extent fragmentary, and in the nature of things unequal, and that some of the amateur teachers are not practised instructors. Whether this be so or no, the facilities offered are very many and very great, and especially so in that all-important branch of your studies, the study of design. The elementary class of design, the class of design, and class for colour decoration are worthy the attention of you all as open to you before you can enter the Royal Academy, and to these classes many an architect is indebted for his first opportunity of learning and practising design. The practical side of our art is studied by the members of the Association in many classes, each good in its way, and each taking up a useful portion of the work. The visits to modern buildings, which are organised by the Association, are a means of learning how the best work of the present day is being done, and in themselves would be worth joining for. In the Brown Book of the Association you will find the whole programme set forth, and there, too, you will find the regulations and programmes of all the other organisations which I have alluded to. Let me recommend to your notice the page of advice to students which that pamphlet contains, and to your practice the personal consultation with a member of the committee of advice which it suggests and recommends. Among the announcements in the Brown Book, one will appear for the first time which I should be

glad to believe will be continued for many years, — the Studio established by Messrs. Baggallay & Millard. This new and as yet untried venture, is fortunately in good hands, and if proceeded with, ought to afford admirable assistance to students in draughtsmanship and design and I hope also in construction. The Royal Institute of British Architects does not give any courses of instruction, but it possesses the best architectural library in London, and this is now accessible without charge and without more than the needful formalities to all working students of architecture, including students at this college. The City and Guilds Institute has given in the month of July short courses of lectures on subjects, most of which are of value to architects. These, no doubt, will be repeated next summer. The establishment at this Institute of various classes bearing on our pursuits is in contemplation, meantime a class of exceptional instruction in masonry was conducted there last session by Mr. Harvey, and this subject is to be pursued together with the allied subject of descriptive geometry, under the same teachers this season. The instruction given by Mr. Harvey is spoken of by those who know most about it as exceptionally good, and there is nowhere else where the same subject, treated from an architect's point of view, is taught so thoroughly and practically. Here I might well end, were it not that I know that this address, or much of it, will, by the courtesy of the professional press, be read by students who cannot get to London, or who, being in London, cannot see their way to getting to Gower-street or Conduit-street. To any such I should like, with your permission, to address a parting word, and to say, "Courage, my friend. Remember, it is 'the spirit in the man, not the water in the brush'"; and though I have spent the evening describing useful aids to study, there are few of them which a resolute and energetic student cannot dispense with. What I take to be absolutely essential is first work in an office, and that I take it you have; secondly, buildings to study, and there is hardly a parish in England where there is not at least a fragment of the noble Mediæval architecture of our country within your reach; thirdly, books, and of those you must manage somehow to get hold of a few, but if your choice be not large you must the more thoroughly master the ones you have; and lastly, instruction in drawing. That happily the schools of art have spread through the country. Read, I pray you, the "Advice to Students," issued by the Institute of Architects, and appended to the programme of the examinations, and you will notice that there is but scant reference to the London advantages which I have dwelt upon, though I have good reason to think that the Board of Examiners are not insensible to their value; but that the course pointed out is one which a student, with comparatively little aid, may fight out for himself. Still, I am quite sure that the aid offered here and elsewhere will make that course easier, shorter, and I think, surer. In taking leave of the subject and releasing you, let me revert to what was said earlier in the evening upon cultivation. I trust that each one of you will not simply learn his profession and push his way, but will cultivate his mind, and so successfully that he shall be known, not merely as a safe constructor or a brilliant designer, but as a man of taste, of judgment, of varied knowledge, of some accomplishments: in short, that he shall be an ornament to his profession.

Class of Masonry.—We hear that the City and Guilds of London Institute is having a class-room specially fitted for Mr. Lawrence Harvey's class of masonry. It will be lighted in such a way that the light will be thrown direct on the drawing or work of each pupil, and that all cross lights and dazzling of the eyes will be avoided. The pupils will only have to bring their drawing instruments, drawing boards being provided by the Guilds Institute. The class will begin work on the 17th inst. Intending members who have not yet applied are requested to send their names before that date to Mr. Lawrence Harvey, 10, Great Queen-street, Westminster, S.W.

The Association of Public Sanitary Inspectors.—At the annual general meeting of this association, held at Westminster Town-hall, on Saturday last, October 1, Mr. Hugh Alexander, Chief Sanitary Inspector, Shoreditch, was unanimously elected Chairman of the Council, *vice* Mr. G. B. Jerram, C.E.

Illustrations.

INTERIOR OF A RENAISSANCE CHURCH.

THIS is a study exhibited a couple of years since at the exhibition of the "Manchester Academy of Fine Arts," in which it is endeavoured to adopt the Renaissance style for a modern town church, in accordance with the requirements of Anglican ritual. The chief points aimed at are, 1, Economy in the cost of fabric (the chancel only being lined with stone); 2, Clear floor space, with uninterrupted view of the altar and pulpit; and 3, Wall space for the adoption of a complete scheme of pictorial decoration.

The church is calculated to seat 1,070, exclusive of choir and clergy, the nave being 102 ft. long, divided into five bays (and having a narthex of 17 ft. more on the west end), and 39 ft. in clear width; the aisles, intended only as passage ways, 8 ft. clear; the chancel and sacrarium 41 ft. long, and having on the north side a morning chapel, and on the south, organ, vestries, &c.

The triforium of the nave contains illustrations of the suffrages in the Litany: "By the Mystery of Thy Holy Incarnation," &c.; with the four major prophets and four evangelists over the chancel arch, on the jambs of which are SS. Peter and Paul, the pillars of the church.

The chancel is surmounted by a dome, proposed to contain an "Adoration of the Lamb," and the transept roofs have angel figures bearing the titles of Our Lord from Isaiah and St. John. Behind the altar (which is raised thirteen steps from the floor of the nave) a reredos, after the manner of well-known Flemish examples, and setting forth pictorially the Eucharistic mystery, extends the width of the church.

The view given shows the north-east angle of the nave, with chancel and morning chapel beyond. W. Henry Jewitt.

COMPETITION DESIGN OF FULHAM VESTRY HALL.

THIS is the elevation of a design which was sent in for the above-named very ill-managed competition, by Messrs. Cheston & Perkin, and the drawing was subsequently accepted for exhibition in the architectural room of the Royal Academy. The elevation is picturesque in effect, and well suited to the architectural associations of the locality. It was intended to be executed in red brick and terra-cotta.

NEW STOCK EXCHANGE BUILDINGS.

THE recent additions to the Stock Exchange on an area of 20,700 ft., between Old Broad-street and Throgmorton-street, consist chiefly of a new "House" (so-called) for markets joined to the old "House," each being about 8,000 ft. in area; also of committee-rooms and offices, with a frontage of 96 ft. in Throgmorton-street, and offices let to brokers, with a frontage, which will be 186 ft. when completed, in Old Broad-street,—through both, an entrance to the Stock Exchange. In the basement of the latter are electric lighting and heating and ventilating engine-rooms.

The new "House" has an octagonal hall and a dome, 70 ft. diameter and 100 ft. high, two arched transepts with apses, and irregular aisles.

Materials used:—Peterhead granite high plinths, dome piers in large blocks with moulded bases, frieze round, doorways and archways; half-polished Aubigny and Portland stone arches, cornices and pendentives; Pavonazzetta Carrara marble walls, built with them. The dome riveted iron construction shows inside with moulded panels of Hitchins's wire-work plastering; the latter also over transepts, and the same plastering in ceilings throughout the building. Entrances, lobbies, and staircases lined with Turkey red, Ipplepen and Initian marble. Joiner's work: wainscot and mahogany. The dome covered with diamond-shaped leaves in copper; all other roofs with lead. The fronts in the streets are Portland stone and granite.

Below the new Stock Exchange is a settling-room, lighted by electricity, as are also the strong rooms and the buildings above. The plastering of the old "House" has been removed, the pillars covered with Koreo and Giallo-Antico marble from the Roman quarries near Carthage, with Belgian pedestals, the walls with Pavonazzetta.

About 700,000 cubic feet of air, cooled or warmed as required, are driven in per hour by fans, the exhausted air also being drawn away by similar means.

The work has been carried out from the pesigns and under the superintendence of Mr. J. J. Cole.

HOUSES, CHISWICK.

THE drawing now published illustrates three buildings on Chiswick Mall. To the immediate right is shown old Walpole House, recently repaired for re-occupation. There is much that is interesting in its history, as it extends back to the Domesday Survey. In the Monasticon it is mentioned as in possession of the Dean and Chapter of Westminster, a prebendal house belonging to them having stood upon its site. Walford states that Barbara, Duchess of Cleveland in Charles II.'s time, died in the house, and that Dan. O'Connell later lived there some years.

Next to Walpole House are two semi-detached houses recently erected, and further to the left is Eyot Villa, the residence of Mr. John Thornycroft. Mr. John Belcher was the architect, and all the works have been executed by Messrs. Adamson. The drawing was in the recent Royal Academy exhibition.

TOMBSTONES OF THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

MANY of our country churchyards contain examples worth preserving of these interesting memorials. Frequently moss and lichen so thickly cover them, that the ornament is nearly hidden, but they have probably acted as a preservative.

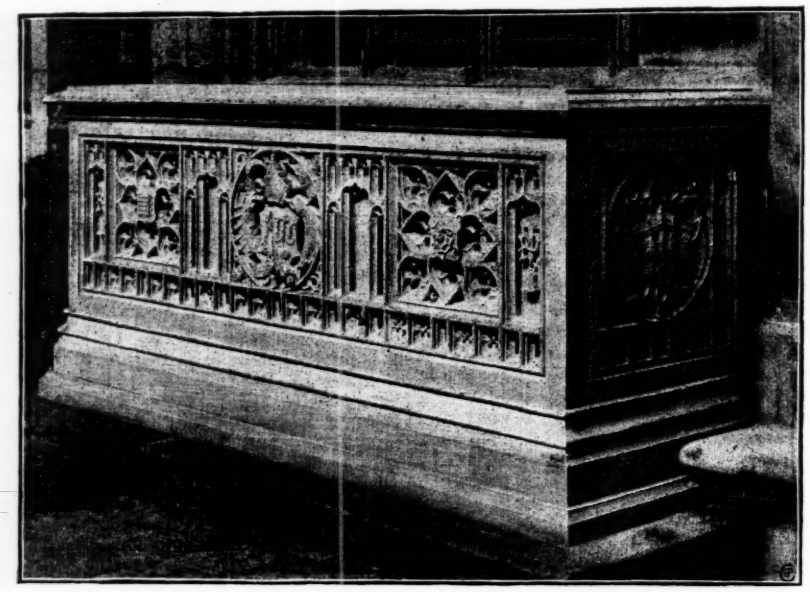
The examples here given are taken from four churchyards only. The Quennington altar tomb is much injured by the roots and stems of ivy, and the turf is now above the base; but the one in Tewkesbury Abbey churchyard has been recently removed, and carefully re-set, owing, we believe, to the judicious and loving care of Mr. Collins, the builder. It is of a fine grained stone, and the carving delicately finished, but it is weather-worn in places.

Some of the designs are rude, but there is a character and feeling about many quite lacking in much of the modern machine-made work for the like purpose; and they seem to show that a certain traditional art lingered among masons in quiet country places long after it had disappeared from large towns.

The Gothic revival has caused rather a feeling of contempt for them, quite undeserved, and has led, in many instances, to their destruction. All antiquarian and artistic feeling should be opposed to this, and it is the desire to foster a better appreciation of them which induces us to give these illustrations.

Society of Engineers.—The Society o Engineers had its first meeting for the Session 1887–8, on Monday evening, October 3rd, at the Town-hall, Westminster, Professor H. Robinson, President, in the chair, when a paper was read on "Stability of Factory Chimneys," by Mr. R. J. Hutton. The author entered fully into the theory of stability of tall chimneys, pointing out some errors in the formulæ ordinarily used, and, in connexion with stability, considered the relative effects of wind pressure on various forms, as circular, octagonal, and square, and at various angles. He then showed that the section of chimney which combined the highest theoretical stability with the least amount of material was not the same as that required by practical considerations for its greatest efficiency in producing draught, and that a compromise had to be effected between the two forms. Some examples of successful chimneys were then given, and also of some that had failed, with an examination of the causes of failure.

New Theatre at Brighton.—We hear that the plans for the new Eden Theatre, to be erected in the King's-road, Brighton, were passed by the Local Authorities last week, and the work will be commenced in a few days. The building will, we are informed, "be practically fireproof," and provided with ample exits. Some special features will be introduced in the construction by the architect, Mr. Frank Matcham, of London.



EAST END PANEL.

CENTRE PANEL.

WEST END PANEL.

Monument to Bishop Courtenay in Winchester Cathedral.—Designed by Mr. G. H. Kitchin.

MONUMENT TO BISHOP COURTENAY, WINCHESTER CATHEDRAL.

This monument, designed by Mr. G. H. Kitchin, architect (the son of the Dean of Winchester), has been placed on the spot where the remains of the tomb of Bishop Peter Courtenay, who died on the 22nd September, 1492, were discovered by the present Dean in December, 1885. The coffin was then discovered having on its lid a long cross, at the foot of which was a small shield with the Courtenay arms. Round the coffin-lid was the inscription "Hic recondita sunt ossa Petri Courtenay, Episcopi primo Exon. deinde Winton, qui obiit A.D. MCCCCXCII."

As the tomb stands close up to Fox's Screen three sides only of it are seen. Of these the long northward front has three chief panels. In the centre are the arms of the Bishop impaled with those of the See of Winchester, under the mitre; the shield has for supporters two dolphins, as we see them round the shield outside the Lady Chapel. Underneath is the Bishop's own motto, which appears also in the Lady Chapel, "In gloriam Dei." The right and left panels bear each a shield in centre, charged, the one with the Tudor rose, the other with the Portcullis, symbols which indicate the Bishop's close connexion with his friend and master, Henry VII. In the outermost small panels of the front is a symbolic ornament, which the Bishop employed elsewhere, a T cross, with the initials P.C. attached, and a bell suspended from it. This bell is an allusion to the great "Peter's Bell," which the Bishop gave to Exeter Cathedral.

The panel which fills the western end of the tomb bears the coat of the Courtenay family, with two swans as supporters on it; and over it and the corresponding panel on the east front is a scroll bearing the motto, "Honor Deo et Regi." The supporters of the eastern shield, which carries the arms of his father and mother, are two boars.

The lesser ornaments, the T cross and bell, and the gerbs and sickles in the spandrels of the larger panels, are all taken from the splendid chimney-piece which the Bishop placed in his palace at Exeter, where it is still to be seen.

The carving has been executed by Mr. Whitley, under Mr. Kitchin's superintendence.

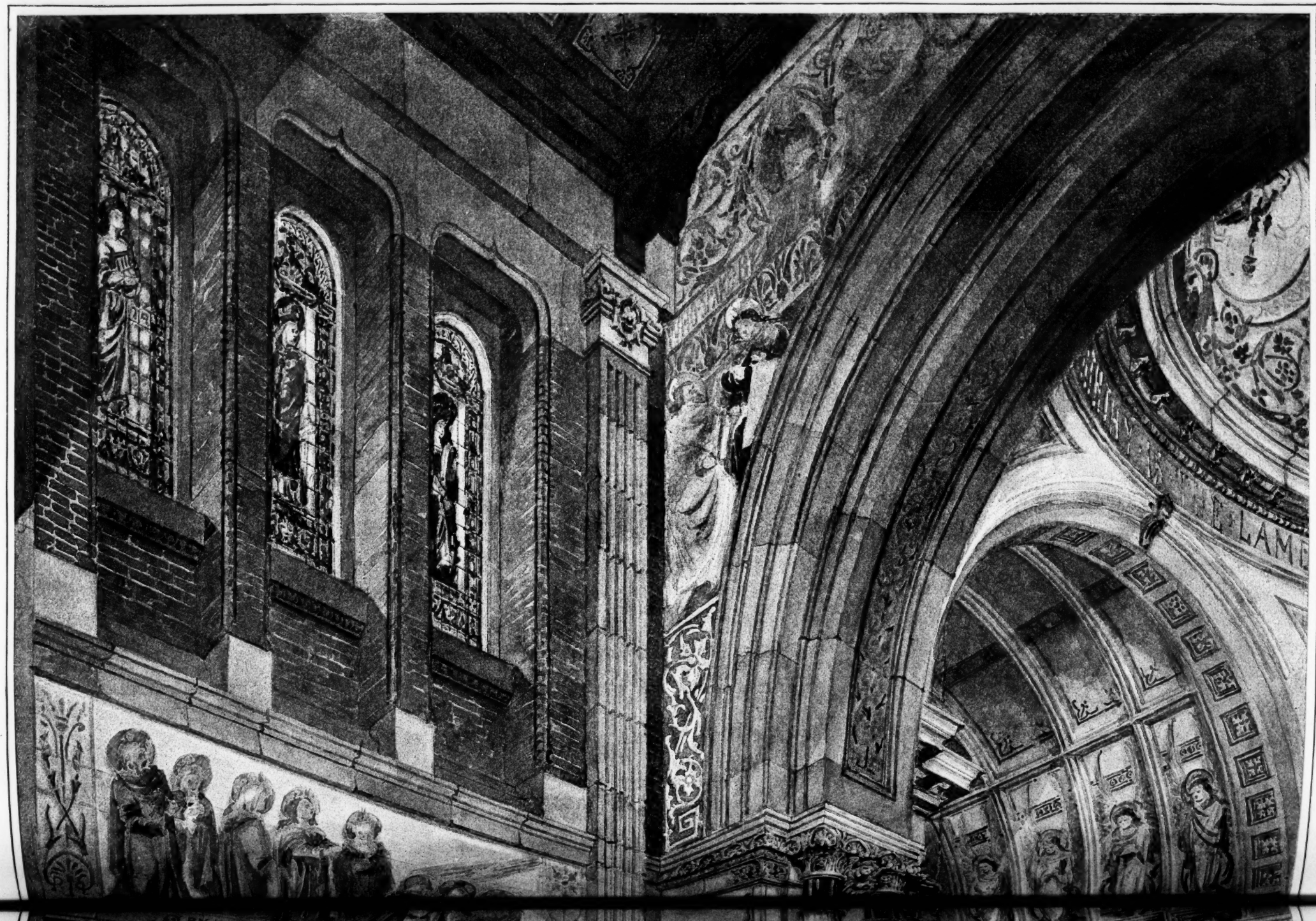
ON THE SIZE OF HOUSE DRAINS, AND THE USE AND MISUSE OF TRAPS.*

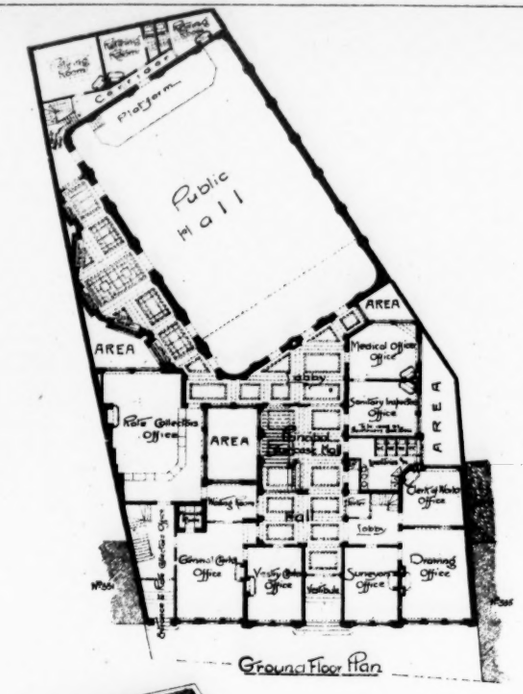
Recent investigations seem to prove that certain elements of ordinary atmospheric air, —chiefly oxygen,— acting upon aërobian microbes, destroy or attenuate their virulence, so that in either case the microbe, as a vehicle of specific disease, is annihilated. The significance of this fact, in relation to the proper ventilation of sewer and house drains, has, I think, not been generally realised. The earlier advocates of such ventilation,—among whom I venture to claim a place,—aimed rather at the dilution and rapid removal of sewage emanations than at the destruction of associated microscopic organisms; but they were not without some apprehension of the truth, since demonstrated, that such organisms are practically destroyed by the action of atmospheric oxygen. It is exactly thirty years since I myself published a paper on sewer ventilation, in which I endeavoured to arouse the better class of my fellow-citizens by pointing out the fact that while they in the most elevated and least crowded parts of the city had to submit to the frequent recurrence of epidemic disease, the people on the banks of the river (which seemed to them so pestiferous) were almost exempt from anything of the kind. And my explanation was this: I said that "the agents at work in both localities were identical, but they were *differently developed*." In the one case tainted air, undiluted and confined for miles in unventilated sewers, remained pestilential, whereas in the other, "mingling freely with the atmosphere, it became harmless,—as a homœopathic globule in a glass of water." I should be inclined to use very much the same language now,—and I regret to say there is almost as much need to use it,—but we have made an immense stride when we are able to plant our feet upon ascertained fact instead of reasonable but somewhat vague deduction.

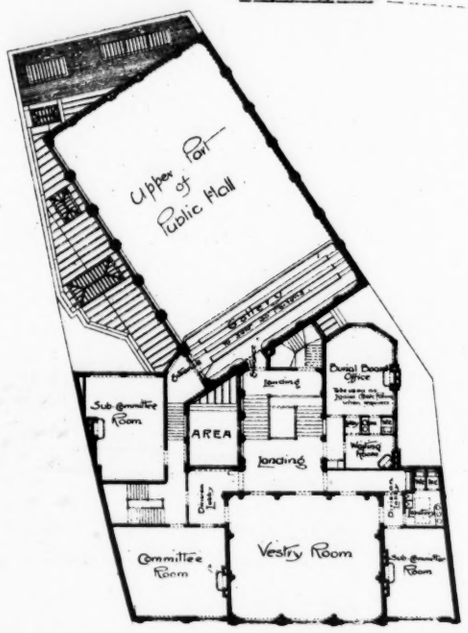
We may, indeed, say that we have now a new and potent argument in favour of drain ventilation. We advise it not merely for the dilution of noxious gases, and their rapid removal, or for the relief of hydrostatic pressure, or the aëration of sewage, but also for the destruction of disease germs, or at least the attenuation of suspended virus; and it is evident that if we succeed in this we render our aërial drainage, if I may so call it, innocuous, so that even if it accidentally

* From a paper by Mr. John Honeyman, F.R.I.B.A., read at the Bolton Congress of the Sanitary Institute.

STUDY FOR A MODERN RENAISSANCE CHURCH. By Mr. W. H. JEWITT.







FRONT ELEVATION.

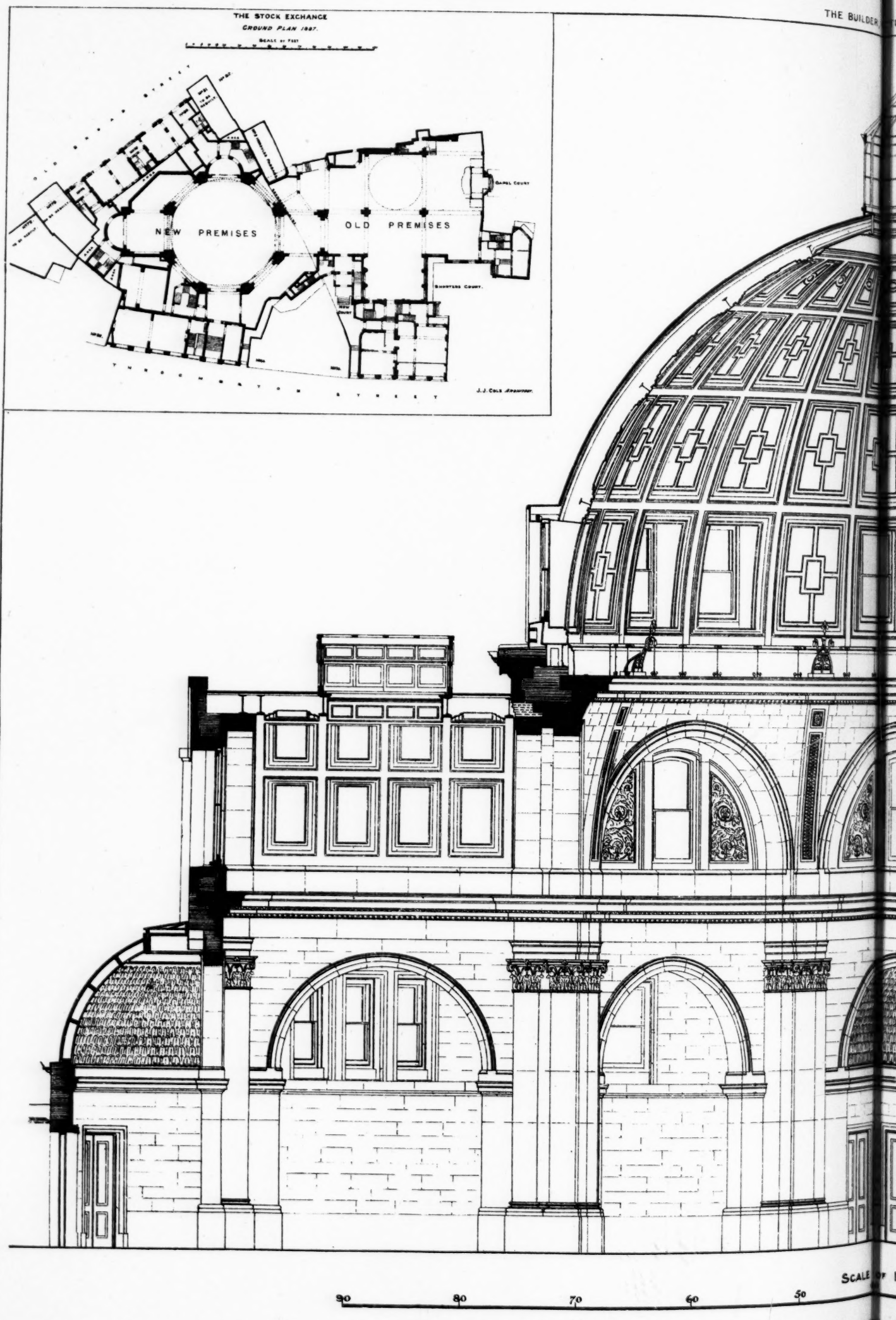
PHOTO-LITHO. SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.

COMPETITION DESIGN FOR FULHAM VESTRY HALL.—Mr. H. Cheston, F.R.I.B.A., and Mr. J. C. Perkin, Architects.

PHOTO-LITHO., SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.

THE STOCK EXCHANGE

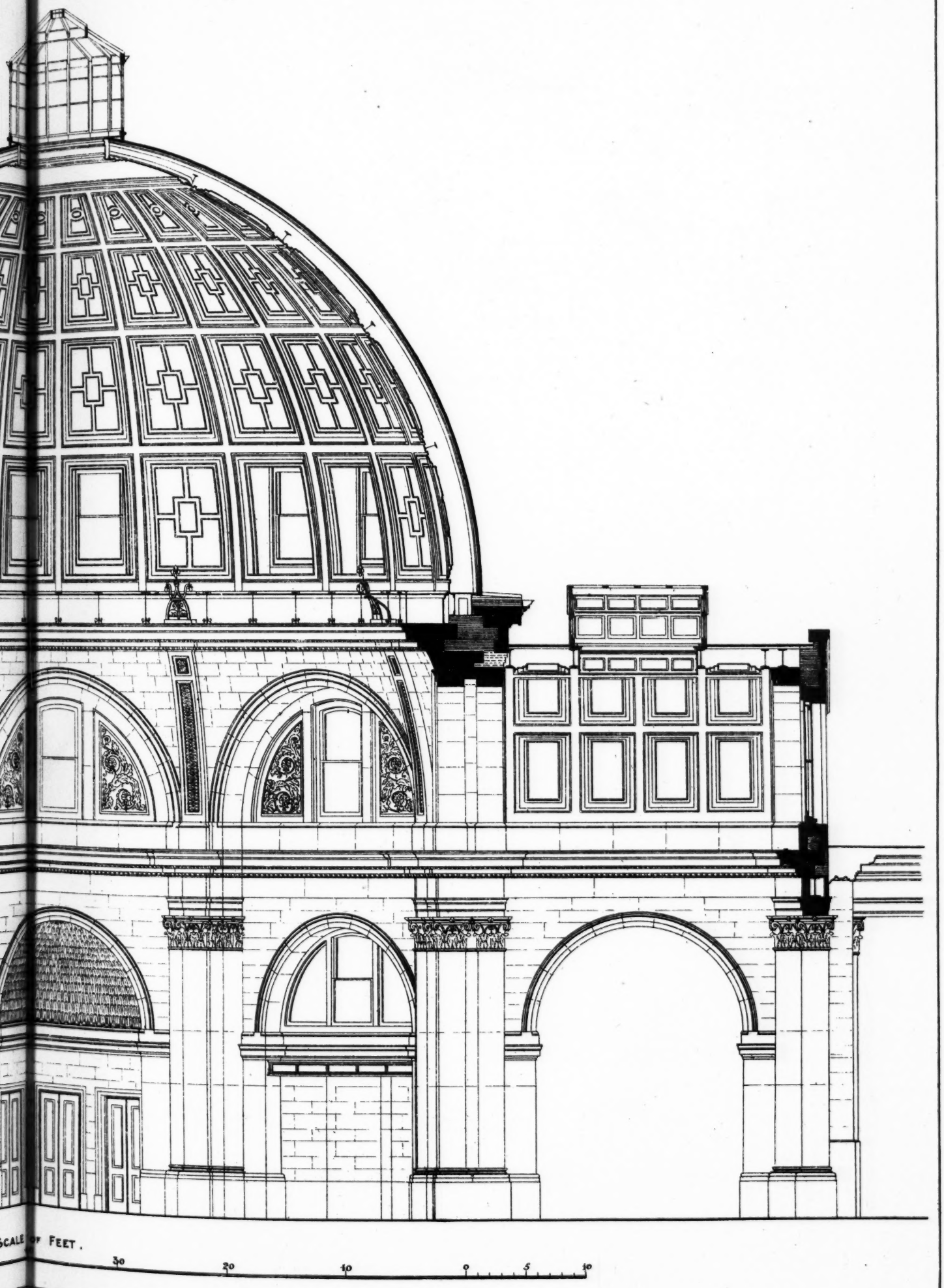
GROUND PLAN 1887.



C. F. Kell Photo-Lith & Printer.

ADDITIONS TO THE STOCK EXCHANGE, THROGMORTON S

LONGITUDINAL S



SCALE OF FEET.

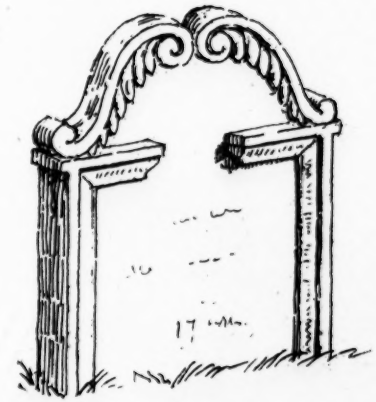
30 20 10 0 5 10

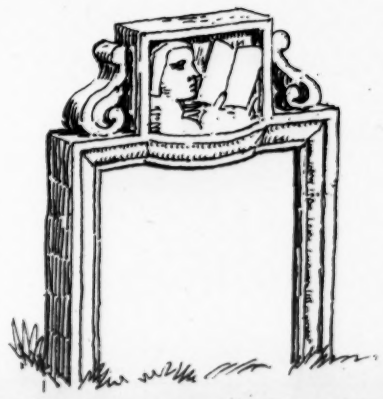
MORTON STREET, CITY.—Mr. J. J. Cole, F.R.I.B.A., Architect.

GITUDINAL SECTION.

8, Furnival St Holborn, London, E.C

HEADSTONES AT COLN SAINT ALDWYN GLOUCESTERSHIRE





ALTAR TOMB AT QUENNINGTON GLOUCESTERSHIRE

DRAWN BY MR. G. R. CLARKE.

Wyman & Sons Photo-Litho

G^t Queen S^t London W.C.

HEADSTONES 1 TO 5 AT COLN St ALDYN GLOUCESTERSHIRE

№6 ORCHESTON St MARY WILTS

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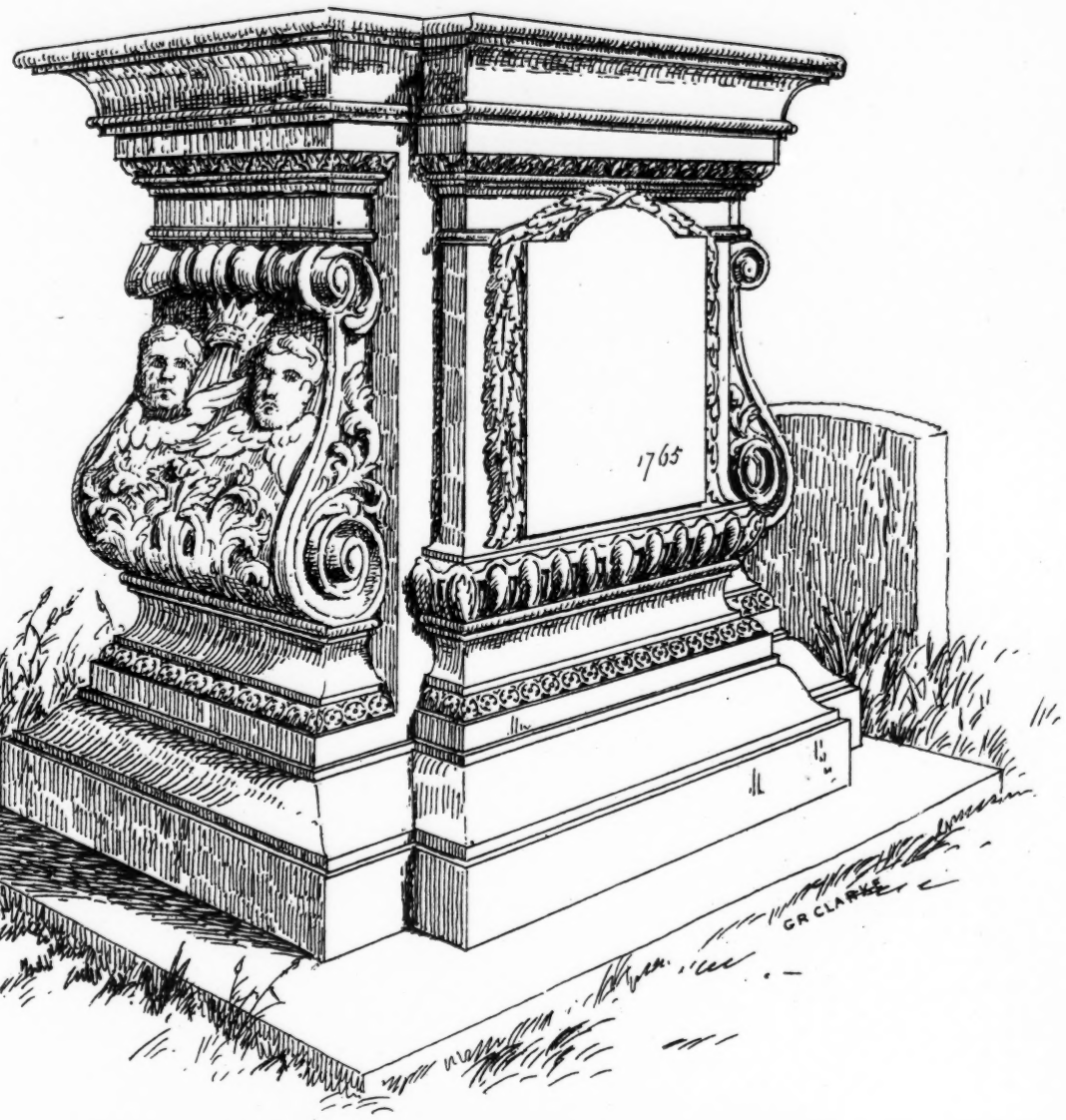

ALTAR TOMB AT TEWKESBURY ABBEY

Drawn by Mr. G. R. Clarke.

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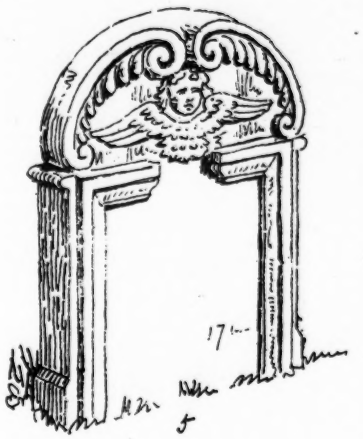

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C. Queen St. London, W.C.

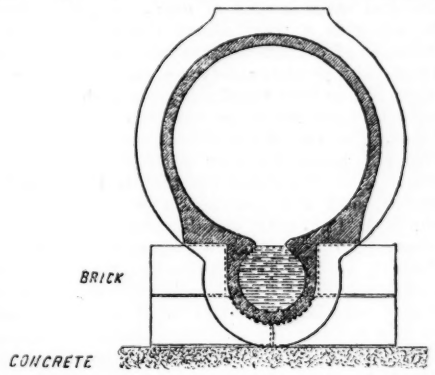
gained admission to our houses it would do no harm. To secure this, however, even partially, it is obvious that we must allow a much larger volume of fresh air to pass through our drains than has hitherto been customary,—in short, the more nearly we can make them approach in airiness to the condition of open drains the better.

These remarks apply to drains of every size, but in this short paper I shall refer to house-drains only. One reason why I do so is that it seems almost a hopeless task to convince those who have control of the common sewers that anything in the shape of ventilation is called for. After nearly forty years of sanitarian effort, argument, entreaty, and painful and costly experiences, it is now almost as necessary as ever that those who connect their drains with common sewers should carefully protect themselves against the risks they run in doing so. In this and many other things, sanitarians have been very much like the "importunate widow," but after so many years' ineffectual reiteration of the same tale, they may almost be pardoned if they begin to despond. In the case of house-drains, however, they are able to appeal to individuals, and individuals are more amenable to reason. Now, our house-drains are under our own control; we can cut them off entirely from the common sewer and ventilate them as much as we like; and in view of the facts already referred to, this important question presents itself: Do we in practice ventilate our house-drains sufficiently to secure the best results? I think it is perfectly manifest that we do not, and that it is simply impossible to do so with drains of the size generally used.

Pipes of small diameter are recommended to facilitate rapid flow and scour; but we want rapid flow and scour of aërial as well as of liquid sewage, and we are met by this difficulty, that whereas small pipes are best for the one purpose, large pipes are absolutely necessary for the other. Now, while we admit the importance of dealing with the aërial as well as the liquid contents of drains, we have hitherto made no adequate provision for doing so. We have, no doubt, several schemes of drain ventilation which are theoretically good, and which are useful so far as they go; but they stop a very long way short of that thorough flushing of the drains with fresh air which is desirable. In order to bring out clearly the difference between what is usually done and what I think ought to be done, let us suppose that we are dealing with a house of moderate size, having, say, two baths, three water-closets, three basins, and three sinks. A 4-in. pipe would suffice to carry away the sewage from such a house, but in practice a 6-in. pipe would probably be used. Now in many,—I fear I must still say in most,—cases no attempt would be made to ventilate this drain at all, although soil-pipes connected with it would for the most part be ventilated. In some an outlet-shaft would be provided, 2 in. in diameter, in some 3 in., and, in a comparatively small number, shafts 4 in. or 4½ in. in diameter. Let us consider the state of matters in such a drain with the outlet-shaft of the largest size. If we suppose that the contents of the drain would fill a 4-in. pipe, the 4½ in. shaft would give an area almost equal to that of the remaining empty segment of the 6 in. pipe, so that, roughly, what we have to do is to ventilate a tube, say 5 in. in diameter and 100 ft. long, the greater part of which is horizontal. Even assuming that there are no restricting cowls or gratings at either end, it is manifest that in such a tube there could hardly be any appreciable current without the application of great mechanical force, even if we suppose the tube to be smooth and empty. But the tube we have to deal with is neither. It is rough, and it has for the greater part of its course an exposed surface, greater than that of a 5-in. tube, part of which is in motion in an opposite direction to that which the aërial current would naturally take. In such circumstances it is evident that the current would not only be sluggish, but variable, now in one direction, now in another, and often, when opposing forces were well balanced, stagnant. If such be the condition of a drain with a 5-in. air-outlet, I need hardly pause to consider the condition of the great majority now in use, which have nothing like so much ventilation.

Of course everything depends on what we mean by ventilation. If we mean by that term such a change of air in the pipes as is possible under the conditions just described, we may admit that some of our house drains are ventilated; but if we mean by it constant flushing of our drains with fresh air having something like its normal proportion of oxygen, then I fear we must say that none of our house-drains are ventilated; with such restricted sectional area and consequent friction the thing is impossible.

The question then comes to be, can we provide the air space necessary for ventilation without either extending the exposed surface of the sewage or of the contaminated periphery with which the air must come in contact? I venture to think that it is quite possible, and indeed easy, to do so by means of a simple contrivance which I now submit to you (see diagram). A drain-pipe such as this may



be made of any ordinary size, but assuming that one having the upper portion 12 in. in diameter would suffice, let us contrast it with the drain already described. In the first we had a sectional area for the transmission of air of (omitting fractions) 15 in., in the other you have 120 in.; in the first the surface of sewage exposed is 6 in., in the other 2¾ in., assuming that the maximum flow would fill a 4-in. pipe; so that in this new pipe there would be fully a half less exposed surface of sewage and eight times the amount of air with increased velocity; besides which the flow of sewage would be more rapid, being more confined. In such a drain 100 ft. long, open and unobstructed at both ends, the current would not be overpowered by friction, and would hardly be affected by the comparatively trifling area of moving surface; and we by no means advise that it should be open at the two ends only, but at as many points as practicable along its course. Dealing with comparatively pure air we should be at liberty to make intermediate openings without risk,—the fresh air would thus have the upper hand and keep it. We can give air as well as water too much to do, and in fact it is more dangerous to overcharge air than water with impurity.

But while I recommend the use of large pipes immediately in connexion with the house,—that is to say, on the inlet side of the manhole and intercepting trap,—I must observe that in most cases it will be advisable to use pipes of small diameter between the intercepting trap and the outfall, especially if that outfall be a common sewer. In that case our object must be to leave no room for air in the pipe,—to use pipes large enough to hold the sewage and no more, so that when full, or nearly full, the air may be expelled from them. I speak of things as they are, not as they ought to be. Our sewers ought to be in a different condition, but while they remain a source of danger the more completely we shut them off from our dwellings the better, and the less we allow their polluted air to remain in contact with the seal of our intercepting trap the better. Where the outfall is good and the branch may be safely ventilated the large pipe of the section shown will be best. In short, the use of the one or the other is indicated by the practicability or otherwise of thorough ventilation.

I must now make one or two remarks on the use of traps in connexion with a thoroughly ventilated house-drain. The complete isolation of a house-drain is a fundamental condition. It must not be connected aërially either with a common drain or with the drain of any other house. Having secured that condition by means familiar to you all, and having also secured the thorough flushing of the drain with fresh air and water, it follows that trapping, as a protection against foul air, is unnecessary.

We are practically safe, and the fewer traps we have either outside or inside the better. We do not require to trap soil-pipes, rain-water pipes, or gullies; and by leaving them trapless we only the better insure the purity of the air in the drain. The truth is that by a multiplicity of traps we create a multiplicity of obstructions and deposits, and to that extent interfere with the rapid cleansing and efficient ventilation of the drain. The only excuse for using traps inside at sinks, baths, and the like, is to protect the inmates from cold draughts and smells from waste-pipes. For this purpose some obstruction is no doubt necessary, but it need not take the form of a syphon trap. If it does it is most desirable that every trap of the kind should be accessible and cleansable from the vessel with which it is connected. Scullery sinks should be provided with a grease-box, which would also serve as a trap; but it ought to be inside, easily got at, and regularly cleaned by the servant who works at the sink. By appliances at present in use it is impossible to catch the grease in close proximity to the sink, especially where much hot water is used, but I think the difficulty may be got over by a contrivance which I shall now describe. This consists of a shallow box encased with cold water, and covered with a movable grating resting about ½ in. or more, according to circumstances, below the level to which the waste water will rise. The casing or jacket is really an expansion of the cold water supply to the sink, and the water in it would therefore be frequently replaced. The contents of the sink entering this box would at once spread over the cold bottom and impinge against the cold sides and raised central division. Much of the grease would rise through the grating and congeal above it, and thence be easily removed; but a good deal would, no doubt, adhere to the bottom and sides of the box. A depression is made at the end of the box to catch sand or other solids; the size would be in proportion to the amount of work to be done in the sink. It is evident that such a box would be quite easily cleaned, and that the cleaning of it could not be neglected without interfering with the use of the sink; moreover, as it would not be enclosed in any way, it would not be out of sight and therefore out of mind.

I shall conclude with a word or two about the trapping of water-closets. The ordinary wash-out closets have necessarily traps which prevent the inconvenient or otherwise objectionable ingress of external air, but I have no doubt that a good valve closet without any trap is hygienically a greatly superior apparatus. The external air is effectually excluded in this case by the water held in the basin; but it would be *sufficiently* excluded by the valve itself if we assume that the air in the house-drain is innocuous; there is, therefore, no use of a trap in addition to the valve, and without that obstruction the contents of the closet are at once discharged into the drain and carried clear of the house in a few seconds. In this way you not only with certainty get quit of excrementitious matter, but also of water which has been in contact with it; whereas in trapped closets you may get rid of the former but not of the latter, and in many varieties you get rid of neither. It is about twelve years since I first ventured to use trapless closets, and I have recently had an opportunity of comparing some of these, which have been in use for more than ten years, with trapped closets of about the same age, with the following result: in no case was I able to detect the slightest smell from a trapless closet, however long I held the valve open, and in every case where the closet was trapped a most offensive smell was perceptible if the valve were kept open for a few seconds. All my experience, indeed, points to this,—that our best chance of safety lies in so contriving our house-drains and plumber-work that there shall not be one single receptacle where stagnation is possible throughout our entire system, and that the pure air of heaven shall constantly permeate every nook and cranny of it.

Besides plenty of air, a good scour, and periodical flushing, one thing more is desirable, if not essential, if the contents of our house-drains are to be harmless, and that is that they should be regularly cleaned. I may not enter upon this subject now, but venture to say that I see no difficulty whatever in having this cleaning done periodically at less expense, and with very much less trouble to the occupants of the house, than a somewhat analogous operation to which we are quite accustomed,—the sweeping of chimneys. There is, indeed, no reason why we should not have drain-sweeps as well as chimney-sweeps.

PUBLIC SEWERS, AND HOUSE DRAINAGE.*

Public Sewers.

As the necessity for some of the requirements of house drainage depends on the sewer, the writer proposes to say a few words on this subject before dealing with house-drainage proper.

So far as the drainage of a house is concerned, it is necessary to deal with sewers as they exist, not with a theoretically perfect condition of things. Sewers, as separate pieces of construction, may be, and frequently are, admirable; but as channels for the rapid removal of all that passes into them they are faulty.

Sewers in most of our towns are designed not only for the removal of excreta and vegetable matter, but they have also to receive a large amount of storm-water, necessitating the presence of washings from roofs, street sweepings, &c., and they should therefore be constructed to provide a rate of flow in them which shall remove much heavier substances than those contained in sewage proper. If this be not done, the more ponderable matter will subside, and even if this subsidence be regular, there will be a considerably reduced rate of flow due to friction; and as the subsidence never is regular, bars will be formed in the sewer which, unless removed by flushing or excavating, will in time close the sewer altogether, or make it nothing better than a cesspool.

The necessities of practice and the configuration of the ground in almost all cases prevent the possibility of sewers, worked by gravity only, being laid to such gradients as will produce a regular rate of flow sufficiently rapid to remove the ponderable matter, or the sewage proper, in a space of time sufficiently short to prevent deposits and fermentation in the sewer; thus, as fermentation must necessarily take place, and as the householder has no power over the cleansing or ventilation of the sewer, it becomes his duty to separate the occupants of his house from the possible and probable effects of any direct connexion with a receptacle or channel which contains gases injurious to health, and may contain the germs of serious disease which have passed into it from some other habitation.

If the drainage of all houses were in such a condition as to get rid of all matter liable to decomposition at once, and it were not the fact that, owing to the faulty construction of many house-drains, decomposition has already become active before the matter to be removed has ever reached the sewer; if the sewer were self-cleansing and thoroughly ventilated, and the dangerous matter were removed before fermentation set in; if it were not the channel through which must necessarily be passed excreta carrying with them the germs of disease, there would be no necessity for the careful separation of the several systems of house-drainage from the sewer proper. But, as sewers do receive matter already decomposed, as they do not at once remove matter subject to decomposition, and as they are not thoroughly ventilated, it is necessary that each house should be disconnected as effectually as possible from any chance of contamination from this source, and the intercepting trap between the main house-drain and the sewer is a necessity.

Much exception is taken to the system at present in force for the ventilation of sewers, and it is proposed by some to put a large ventilating-shaft at the head of every sewer; but a very small amount of calculation will prove clearly that, even if the openings into the street were closed, any such system would be perfectly ineffectual, and that if the street-openings remain as they are, any such ventilation would not extend beyond the first or second of these openings. If sewers could be cut off into short lengths with an effectual seal at either end there would be no difficulty about the matter; such an arrangement is easily ventilated; but how to ventilate a large length and area of pipes, opening in many places either into the air or to other sewers, the writer knows not. The ventilation of a coal-pit will serve to illustrate the difficulty.

Street-openings are frequently offensive to the sense of smell because the sewer is foul, but this is not a reason for closing up the openings into the streets, which would have the effect of forcing the gases into the houses by the pressure of the sewage when increased in volume during the day, or by a sudden access of storm-water, or by the expansion of the gases themselves, or by a combination of two or more of these forces; but it *is* a reason for increasing the number of openings, and thus reducing the temperature in the sewer as compared with the outside atmosphere in cold weather, and diluting the gases to the utmost extent possible. It is of course obvious that if fresh air be admitted foul air must be expelled.

If sewers can be efficiently ventilated there should be no delay in doing it. The proposal which seems to the writer to have the most practical value is that of carrying a pipe from the sewer to a point above the roof of every house, or of certain houses on one side of the street only, or alternately on one side and the other, but so that ventilating-pipes shall not be opposite each other on the two sides of the street. The ventilators should not be connected with the house-drain or with that part of it which is in the street (as this is liable to be flooded, and the ventilation would then be stopped), but with the highest point in the sewer. To make such a system of ventilation efficient, it would be necessary that a street-opening should be placed midway between each pair of ventilating-shafts; or if the shafts did not rise to the same elevation above the sewer, they should be so spaced that each should receive an equal amount of air in proportion to its requirements from the street-opening, and the latter should be of ample dimensions, so that the indraught should not be checked. Taking the difference of temperature between the column of air in the ventilating-pipe and that of the atmosphere at the street-opening at 5°, or assuming that the expansion of the gases produces a head equal to this difference of temperature, then a 4-in. pipe 40 ft. high might be expected to change the air in a 60 ft. length of 3 ft. sewer running one-third full, in 13·7 minutes (see Hood on "Warming and Ventilating Buildings," p. 364); or in other words, in order to change the air in 27 cubic feet capacity of sewer five times per hour, a ventilating-pipe 40 ft. high, and having a sectional area of 12·56 in. will be required, on the supposition that a difference of temperature equal to 5°, or a difference of head representing the same amount can be secured. Having made these few remarks on the condition and ventilation of sewers, the writer proposes to proceed to the consideration of house-drainage proper.

House-Drainage.

It is proposed to take certain propositions as axioms granted by all sanitarians, and to enlarge on these. The axioms are taken from a report prepared by a committee appointed by the Civil and Mechanical Engineers' Society. If no remark be made on any particular axiom it is considered that none is required.

(1.) Every drain, or part of a drain, inside a house, and all soil-pipes, shall be water-tight throughout. The writer believes that this requirement can be thoroughly carried out with glazed stoneware pipes, if they be thoroughly bedded in concrete, and no contact with any part of the foundation of the house be permitted. He, however, prefers to use cast-iron pipes where a drain passes through a house, and considers that with this material it is to be preferred that the supports should be at considerable intervals, that access to all the joints should be simple and easy, and that the drain should be in such a position that it will come under constant inspection. Under these conditions leakage can be quickly detected, and injuries from rusting may be reduced to a minimum.

(2.) The main drain of the house shall be ventilated at its upper extremity by means of a continuation of the soil-pipe, or by a special pipe provided for the purpose, such ventilating-pipe, whether connected with the soil-pipe or otherwise, having a clear sectional area of at least 10 square inches throughout, and being carried to such a height that its outlet shall be at least 3 ft. above the eaves of the roof, and the same distance above any window or opening in the roof not being a chimney, and not less than 6 ft. distant from any chimney or opening in the roof, whether of the house to which it belongs, or of the next adjoining house, measured in any direction. The main soil-pipe shall be similarly ventilated, and if there be more than one soil-pipe, then each such soil-pipe which shall be longer between the basin of the closet and the main drain than 8 ft. shall be similarly ventilated. The main drain shall be disconnected from the sewer or cesspit by means of a syphon trap of approved construction, provided with means for cleaning the trap and the portion of the drain between the trap and the sewer or cesspit, and it shall be ventilated by an inlet air-pipe or ventilated disconnecting manhole; and if there be more than one outlet ventilating-pipe connected with the house-drain, then each such portion of drain and outlet ventilating-pipe shall be provided with a suitable syphon trap and an inlet air-pipe, or disconnecting manhole, as already described; and the area of the inlet air-pipe shall in all cases be at least double that of the outlet ventilating-pipe in the clear.

It is contended by some writers that the inlet for fresh air should be at the head of the drain, and the outlet at or near the disconnecting manhole. The objection to this arrangement is that the soil-pipe will either remain unventilated, or a separate system of ventilation will have to be provided for it, thus introducing unnecessary complications. The argument in its favour, that it follows the flow of the drain, does not seem to be at all conclusive, for as no house-drain ever runs more than one-third full, unless under most exceptional circumstances, there is not much reason to fear that the air passing up the drain, which is more volatile than the water flowing down it, would have its current arrested by the traversing current of water; on the contrary, it is probable that the effect would be that the current of air would be temporarily accelerated, and especially would this be the case when, as frequently happens, the drain has a diameter of 6 in., while that of the ventilator is 4 in.; also, if the water in the drain were giving off vapour, this would rise in the drain and travel in a direction contrary to that of the water; this, therefore, seems to be the natural direction of the current.

Writers have repeatedly stated that the number of ventilating-shafts should, if possible, be increased indefinitely, and from some of the statements to this effect it may be inferred that the relative elevation of the several shafts is a matter of no importance, and that rain-water pipes may be used for this purpose. It cannot be too often or too urgently repeated that this is altogether a mistake (see Hood on "Warming and Ventilation of Buildings," p. 360); that under no circumstances should rain-water pipes be used as drain ventilators; they cannot go above the eaves of the roof, and therefore the foul air from them is liable to enter the house; also, if more than one upcast shaft be used it will not,—unless each shaft be of exactly the same height, heated to exactly the same extent, and affected by the wind in just the same manner, — increase the ventilating efficiency, but will rather diminish it. The writer has frequently come across systems of ventilation which were faulty on this account; but when the system of ventilation is simple,—that is to say, where there is one upcast shaft for each inlet, where the inlet opening is of ample dimensions, and leads as directly into the drain as possible, with few or no angles or bends,—he has found no difficulty, and he is of opinion that cowls of any kind should be avoided, and that a mica return flap on the inlet opening is unnecessary. Where the work can afford it, a ventilating disconnecting manhole should be built, as it affords easy access to the drain; but a perfectly satisfactory arrangement can be made without it so long as the drain remains in good order.

The disconnecting trap should be self-cleansing; therefore it must be of large radius, with easy curves in all directions, and there must be no projections or corners in it which will either arrest the flow through it or tend to collect deposit. These requirements condemn all forms of dip trap, and, in fact, the only trap which will satisfy them is the ordinary syphon trap, if the radii of the curves be sufficiently great, and it be of good form throughout and well glazed. No inspection pipe in the middle of the length of the trap is possible; this would seriously retard the flow and cause deposit. A cascade action is recommended by some, but consideration will, it is thought, show that this action, while it may, by the greater head obtained with a small supply of water, force an obstructed trap, does not really offer any advantage which does not exist to a greater degree in the ordinary syphon described above. If with the cascade action a greater

* From a paper by Mr. Reginald E. Middleton, M.Inst. C.E., M.Inst. M.E., Vice-President of the Civil and Mechanical Engineers' Society. Read at the Bolton Congress of the Sanitary Institute.

local head be obtained with a reduced amount of water, it is at the sacrifice of the general gradient of the drain, and therefore of the rate of flow in it. With the cascade action the distance travelled is greater than with the other system for the same fall, and the very fact of the head being obtained proves conclusively that this trap has a retarding effect on the flow, and the conclusion arrived at by the writer is that it is far better to make the best of the gradient procurable, to have a length of drain next to the trap from 1 ft. 6 in. to 2 ft. long, falling at the rate of 1 in 6, than to have a local vertical fall, whether small or great, and that in this manner a far better scouring action and a cleaner trap would be secured than with a cascade action trap.

(3.) No pipe which passes through any part of a house, not being a soil-pipe or soil-drain, shall be connected directly with the main drain.

(4.) No water-closet shall be situated next to a larder or place where food is stored. No pan-closet or D-trap shall be used, and every water-closet shall be trapped, and shall be arranged so as to prevent syphonage.

(5.) The overflows from safes of closets and of baths, and from cisterns, shall be discharged into the open air in an exposed position, and shall not be connected with the soil-drain or rain-water pipes, either directly or indirectly, but shall act as detectors.

(6.) All sinks, baths, lavatories, and urinals shall be trapped with suitable traps, and the discharges from them shall be carried outside the walls of the house, and shall not be connected directly with any soil-drain, nor shall they be introduced under the grating of any trap, but they shall terminate in the open air, and not near any window or other opening.

The writer is aware that many sanitarians prefer to introduce the pipes leading from sinks, &c., under the gratings of the yard gullies; but he thinks that this is a mistake, and that it is far preferable that the discharge should be made fully in the open air, so that there may be as little chance as possible of the collection of any matter in the pipes, than that it should be hidden out of sight and, possibly, choked. If the gratings became foul from this cause, it is better that this should be apparent than that it should be hidden; it is the object of scientific drainage to bring any collections of foul matter to light, not to hide them.

(7.) All water-closets, urinals, and slop-sinks shall be provided with suitable flushing-cisterns, and the flushing-pipe for any closet shall not have a less internal diameter than 1¼ in., and the height of the flushing-cistern above any closet, urinal, or slop-sink, shall not be less than 4 ft. It shall be impossible to draw water from any cistern used for flushing purposes for any other purpose than that of flushing.

(8.) The cisterns used for general purposes shall be easily accessible, and shall be provided with covers ventilated into the open air outside the house by a rising pipe other than the overflow-pipe; and no pipe from them shall be connected in any way with any soil-pipe, drain, or with any pipe receiving the discharge from any bath, lavatory, urinal, sink, or flushing-cistern.

(9.) No rain-water pipe used to receive the waste from any bath, lavatory, sink, or urinal, shall be placed near a window or other opening; and no rain-water drain shall connect directly with a soil-drain, and no rain-water pipe shall be used as, or connected with, the soil-pipe nor as a ventilating-pipe.

Though there are many bad sanitary appliances in the market, the selection of good ones is a simple matter, requiring little more than common-sense knowledge, it being obvious that sharp bends and angles and straight vertical sides are undesirable; that all utensils should retain matter liable to decomposition for as short a time as possible, and should pass it quickly to the drain, which in its turn should pass it quickly to the sewer. Complications both in apparatus and in the drains and ventilating and inspecting chambers, are most undesirable, and economy without loss of efficiency should be studied. Finally, whatever sanitary work is done, it is of the first importance that it should be done well, that the construction should be thoroughly accurate, and carried out in a trustworthy manner.

City of London Court.—A new building for the City of London Court, designed by Mr. Murray, is, the *City Press* says, to be erected by the Corporation, at a cost of nearly 14,000*l*.

THE WALLS OF CHESTER.

Sir,—Mr. Thompson Watkin says I have not answered his question about the absence of mortar in the Chester walls, or, I suppose, in a portion of them. I have, it seems, in vain referred him to the walls of Dijon, Sens, Bordeaux, and Artois. In all of these, as in the walls of other towns, the sculptures were placed carefully without mortar, just as they were found in the Chester and London walls. The *castra* of Richborough, Reculver, and Lymne are, or should be, well known to archæologists. Like that of Chester, the walls are upon layers of boulders without mortar, but above they are strongly cemented. It is in the absence of any underground foundation that the walls of Roman *castra* are distinguished from Mediæval buildings.

When Mr. Watkin asserts that the origin and date of the Continental walls, mentioned above, have been disputed, he is correct; but the arguments used to prove them Mediæval were as illogical and futile as those adduced in favour of a Jacobean theory to explain the walls of Chester. M. Schuermans, in a masterly article on the walls of Artois, has shown the utter impossibility of their being other than Roman. See the *Bulletin des Commissions Royales d'Art et d'Archéologie*, 1877.

Mr. Watkin says that the eminent gentlemen whose names he prints as converts to the theory of himself and Mr. Shrubsole still adhere to their opinion. But is it really so? We do not see them writing in support of it.

As soon as possible, I shall endeavour to give my views on what are now the important questions, namely, to what cause may we ascribe the peculiar construction of the Chester walls; and the probable period. In the meantime, I rest in perfect confidence that truth and common sense will prevail.

C. Roach Smith.

Temple-place, Strood, October 1st, 1887.

Sir,—I will endeavour to complete my remarks on this subject, now that I have Mr. Watkin's reply, page 476. Before doing so I will answer one of his inquiries, the remainder as we proceed. Do I know of any Roman wall in England built entirely without mortar? No. Here is, however, one of the most telling arguments in favour of the Roman theory. If the Romans did not build the wall thus, could any other people? They are, at least, likely to have done so. They would have relied upon the huge size of the stones and their Continental custom, and it would have been in harmony with other works already cited where, in part, mortar is not used. We can in these works trace their tendency to construct in this manner. On the other hand, would any builders of the seventeenth century, or of the time of Anne; or, to go back to the Edwardian period, since a part of the wall is pronounced to be of that time, have been likely to build without mortar? Can Mr. Watkin tell me of any city wall so erected? Or, can he tell me of any other important building? There are three periods for him to choose from. It must be remembered that there was artillery to be guarded against, and is there even the bare possibility of its being omitted in a work of such magnitude as the walls of Chester? I have already shown that it is the lower portion only that is so constructed. Are the builders of either of the three periods likely to have built the base without, and the upper part with, mortar?

The details of the construction now require notice, and the uniformity of design wherever opened is first in importance. At all the points observed there are the same lower courses of massive stones, much the same tool-marks, a plinth of varying size, as we find in the Roman wall of London. No mortar, except to the Roodeye wall, where it is used because it had more to do; to resist, perhaps, the wash of the tides and certainly the thrust of the bank. This mortar is as hard as flint, and Mr. Frank R. Williams has detected pounded brick in it, and has sent me specimens. The work is the same except the mortar, at the Kaleyards, called Edwardian by your correspondent, the same wherever the massive stones are visible. This uniformity of design in the lower portions proves that the latter were built at one time, and it is incredible to think that it could have been so rebuilt at any one of the three periods named, the lower part without, the upper part with, mortar. The absence of mortar to stones confessedly Roman is an item of detail of no little value, since, even on the supposition that the stones were brought from some other Roman buildings, it proves that the Romans did actually build largely without mortar at Chester. The same remark applies equally to the moulded stones which have evidently been taken from a large number of small buildings, which were in like manner built without mortar, except to some of the upright joints. If re-used in Roman times, the absence of mortar is accounted for. If at any later time, it seems incredible. There are the stones, open to the observation of every one, and their evidence in this respect is not capable of being denied. There is, however, an important detail which must now be considered. None of the stones that I have seen have Lewis-holes of modern form. Mr. Jones has kindly measured what does appear for me. They average only 1½ in. deep, 1 in. broad, and 6 in. long, straight sides. Some are T-shaped. It seems impossible or nearly so for stones to be lifted by their means, and if so they indicate that the stones were rolled into position, that labour was cheap, and that progress was slow.

Is any builder of the seventeenth century, or later, with such a mass of work to do, likely to have undertaken it without at least some of our modern appliances? Is not this evidence fatal to any late date?

I may here note Mr. Watkin's remarks relative to the recent rebuilding of part of the wall west of the North Gate. The work he describes could hardly be Roman, except, perhaps, that what he calls the buttress wall may have been, in part, the backing of the wall of Roman date. He is speaking of the south face. Let him look at the north. Nearly all the way up to the little gate referred to, going west from the North Gate, he will see an almost continuous course of Roman stones, in some cases two, in some three, mostly of large sizes, with tool-mark patterns, which appear never to have been disturbed. How far this goes below ground I cannot say. In Mr. Hughes's shed, just east of the new opening, and ninety-four paces west from the centre of the North Gate, is a curious set-off, made up, not with the chamfered plinths as to the east of the North Gate, but with a quarter-round springing from a fillet, very like one of the coping stones we found built up in the wall. Beside this is another stone similar, but shifted in position, as some of the other Roman stones are. All above is of later date, and if opened it is very likely it would be found to resemble the bulk of the poor work described. Why did not your correspondent say something as to these stones? They have always been visible, they are very distinct, and tell their own tale. They can be found again west of the opening named. I am unable to divine your correspondent's objection to regard these stones as Roman work *in situ*. They clearly form part of the wall left and right of the North Gate, where we know, from Pennant's description and view, that a Roman double archway existed until the middle of last century. What more reasonable than that the wall should survive when the gate has been pulled down? In reply to his question, I cannot tell him of any cornice to any other Roman city wall, nor can he tell me of any such wall which retains its full height. We have nothing, therefore, to judge by.

But there is other evidence,—that of cost. It is a very easy thing for any one to assert any date that he considers possible; but at Chester, I believe, this can all be checked by documentary evidence. Mr. Earwaker, in his interesting discourse at the Town-hall, told us that there were hundreds of documents showing the acts of the municipality. I have not examined them, and the test I am now about to propose ought to be decisive for or against me. I therefore asked your correspondent,—p. 441,—(1) which statement as to age he considered most likely to be true, and (2) relative to the extent.

He replies (p. 477), "I believe the newly-excavated portion of the north wall to have been constructed in its present state (or mostly so) immediately after the siege; the North Gate, cornice, and walls" "during the repairs in Anne's reign."

He does not, thus, say that the whole of the city walls are of these dates, as I had understood him to do in some of his other letters. I am unable, therefore, to carry out my test to the whole of the city wall, but still to sufficient for the purpose.

I accept his answer, but it is bound to apply

equally to the small portion of the north wall from the North Gate to the Phœnix Tower, a distance of 394 ft., where the wall is only of moderate height, excepting a portion which I will not include, for it is thinner, clearly of later date than the Roman stones, which do not appear here. They go visibly from one of these points to the other, allowing 50 ft. to clear the modern work at the North Gate, and also the other exception named in addition. The part of the wall above the Roman masonry we must assume for this purpose to have been erected at the same time, as I made clear in my inquiry, or later.

I have taken out the quantities of this portion, and find that, at current local prices, which I have verified, it would cost 2,560*l.* to erect the small length of wall as it now stands, the stone being supposed to be ready to hand for use from some older wall and not bought.

Let your correspondent reduce this to the currency of *temp.* Charles I. or Queen Anne, and let him, or any of his local friends, trace the records of the municipality to find entry of it. I will add to this, to make it even more certain. The Murangers of Chester have (or had) the task of the repair of the wall. Let him search through their accounts as well. If the entry had ever to be made he is sure to find some allusion to so heavy a work. Alas! for the Murangers, theirs could have been no easy office, if your correspondent is right, for this cost applies to only 394 ft. out of eight or nine thousand feet, forming the entire circuit of the city wall.

This is not all. If a careful observer examines these walls he will be able readily to find traces of repair after repair. At the North Gate he can count six such places close together. If this were a new wall at the periods named, the unhappy custodians must have had to pay for all of these since its erection! What a small outlay does the 1,000*l.* for repairs, *temp.* Queen Anne, recorded at Pemberton's Parlour appear? Yet it is spoken of as a heavy outlay (as it doubtless was). The work then done can be readily traced. It seems to be among the newest portions of the wall, done in great part with poorly selected stone, laid after the foolish local plan, any way except on its natural bed. Beside this work, the Roman stones appear to be uninjured.

The Roodeye wall is referred to, and Mr. Watkin ventures upon a supposition derived from its present position, with the readiness so often met with. Conjectures in this respect are of no value. I have my own, but I do not state them for this reason. In the meantime it has to be remembered that it lines out exactly with the present western wall at Water Gate.

Finally, your correspondent refers to the ease with which Roman stones lying about Chester could have been found when wanted, and he thus accounts for their presence in the wall. Let him take a rule and measure the cubic contents of the vast mass of what he acknowledges to be Roman stones, now in the wall. He will be startled at the quantity, and be bound to abandon the supposition. In the short length of the North Wall already referred to, it amounts to about 21,840 cubic feet. This is sufficient to build a block of masonry about as lofty as the central tower of the cathedral, and about 14 ft. square, but perfectly solid.

A still greater obstacle than the possibility of finding such a mass of stone lying about is the fact that the walls are very fairly coursed. Each is slightly different from those above and below, and there is a certain amount of variation. The builders had, therefore, not only to find Roman stones, but stones that would fit in with the courses, the facework being undisturbed. While this search was supposed to be made, the suburbs of Chester were lying in ruin after the siege, and stone, if wanted, must have been abundant. There was, therefore, no necessity to search for Roman stones.

My remarks have been demurred to on account of the few hours I spent at Chester. I found the time all too long to go through baseless theories, which ought never to have been put forward. I addressed myself to this examination unfettered by any preconceived opinion, except, perhaps, rather in favour of the non-Roman theory, from a recently published article. I am assured that the great bulk of observers will come to the conclusion that the unmortared portions of the walls of Chester are of Roman date, *in situ*, although that Roman date may be a late one, and that the mortared parts are of varying Mediæval periods down to our own day.

E. P. Loftus Brock.

Sir,—Mr. Brock, in describing a section of our north wall (p. 441, *ante*), writes that "from the base the wall rises to a height of about 10 ft. without mortar, and 8 ft. with mortar." Allow me to correct this. I have visited the excavation with the City Surveyor, and on the spot ascertained that from the base the wall of massive stones rises to the height of the so-called Roman cornice 19 ft. 4 in., and is without mortar in its several courses, dry earth supplying its place. The mortar seen by Mr. Brock is a modern and superficial repair on the inner face only. This correction is material, since in judging of its age, or whether it is Roman or otherwise, it is important to know whether 19 ft. of the wall, or, according to Mr. Brock, only 10 ft. of it, is without mortar. Over the area returned by Mr. Brock as mortar, I saw a workman passing his arm between the layers of stone, first removing the dry earth, and then feeling for inscribed stones. I do not think he could have done this with Roman work. I think that most of your readers will agree with me that a wall made up of 19 ft. of loose stones without mortar, supported behind by 14 ft. of soil, has scarcely the look or characteristic features of a Roman military wall, or is likely to deceive any one familiar with such work.

George W. Shrubsole.

Chester, Oct. 1st, 1887.

Sir,—Permit me to supplement my letter in last week's *Builder* [p. 476] with a few remarks, more especially on the subject of the Roodeye stones, serving, amongst other purposes, as the abutment of a bridge across the creek. Naturally there is much inquiry on the point. Excavations on the Roodeye in 1874, for a new intercepting sewer, revealed the fact that this creek *at its mouth* had been some 300 ft. wide. Mr. Shrubsole read a very interesting paper on it before the Chester Archæological Society (see *Chester Courant*, March 28th, 1877), and in my "Roman Cheshire" I have gone fully into the matter. Its bed was peat, covered with silt, and above was rubbish of post-Roman and Saxon times. It existed, though almost completely choked up, till the beginning of this century, or, in fact, till some forty years since, being a large open drain. The deep depression in the field between the wall and the Militia Barracks, and the deep "dip" in the wall itself, reveal its site.

The existence of this creek explains, as I have pointed out ("Rom. Chesh.," p. 103), the passage in the "Polychronicon" that Elfleda "enclosed the city with new walls, and made it nigh two such as it was before, so that the castle that was sometime by the water without the walls is now in the town within the walls." Why the castle any more than the whole of the western side of the walls should be "by the water" would be puzzling, if we had not evidence that the castle rock was more or less surrounded with water, the creek being on its north side, and the extension of the wall from Newgate round the castle, to meet the advanced Saxon wall on the Roodeye side, in the vicinity of this creek explains how the castle came to be included within the walls.

But was the mouth of this creek built *upon* by Elfleda? I think not: but only excavation can show this. If not, a bridge would be necessary, but I do not think it would be an arched one, probably in imitation of Roman work; there would be one or two rude stone pillars and a roadway of timber.

I have always admitted that the large stones supporting the bank at this place are of Roman origin, though not *in situ*, and I should much like to see excavations in their rear. Sir James Picton, I may add, thoroughly seconds this idea, and thinks more would be learned by an excavation on the spot named than in any other.

W. Thompson Watkin.

Liverpool, Oct. 3rd, 1887.

REFUSE DESTRUCTORS.

Sir,—I, with others, have reason of complaint against the general tenor of Mr. Jones's remarks upon Furnaces for the Destruction of Towns Refuse in his paper of a few weeks ago, a reprint of which appeared in your paper of the 10th ult.

In refering to Hardie's patent, Mr. Jones says it is composed of the old saddle-shaped boiler. This is not the case. Again, he says I use forced draught somewhat like Young of Glasgow; again he is incorrect, and does not take the least notice of the most essential part of the patent, viz.: the drying of the refuse in closed vessels or chambers, heated by the waste heat and flame given off by the burning of the refuse on the hearth of the furnace, and drawing off the noxious vapours as they arise through the fan with fresh air, the mixture is forced into the ashpit, and through the burning refuse of the hearth of furnace (which in my patent extends the whole length and width).

The bulk of the noxious vapours arise during the drying of the refuse, and up to now the drying has been carried out in open flues leading to the chimney, and from thence to the surrounding atmosphere, which it contaminates. This is the fault of furnaces of the type of Fryer & Co., and others. I am aware that Mr. Jones says that in passing through his crematory furnace the objectionable fumes are burned and destroyed. I say, but to a very limited extent, unless with very large additional cost of apparatus. It being impossible to burn them without air, or other supporter of combustion, if cold air is used temperature is reduced, or if heated there is the increased expenditure of heating it, besides requiring a separate furnace for the work. In my system the fumes of the drying-chamber are drawn off and mixed with air (required for combustion), passed through the grate-bars of the furnace in minute quantities, and with this fresh air, passing immediately through the fire, enters into combustion, along with the matter on the hearth, and becomes innoxious before going to the chimney. This is done by a single furnace.

It is evident that Mr. Jones, having omitted any remarks upon such portions of my patent as are considered points of value, had not examined the specification properly, or that his omissions had an object. He ought to have been more explicit in his remarks, or should have left out any mention of it.

T. G. Hardie.

Burnley, Oct. 4, 1887.

BOLTON EXHIBITION.

Sir,—Thanks for your graphic notice of our patent w.c. in your Saturday's issue.

May we be allowed to point out to you that you are wrong in saying we have no means of cleansing trap of w.c. If you will kindly refer to the diagram again, you will find we provide ready means of access to this trap, and with regard to the washing of the pan, we beg to inform you that in practice we find very little if any soil touching the back or sides. The pan extends considerably towards the back to prevent its being soiled.

Duckett & Son.

THEATRES.

Sir,—To prevent such events as that at Exeter, how would it answer to give always to every person as they pass in to any public meeting or entertainment a small plan with sections showing all the means of entrance of such building? Many would understand them, and thus be as well acquainted with the internal arrangement of such buildings as they are with the outside streets.

It would more than pay the manager of such public buildings or hotels by the advertisements which might be printed upon the back.

R. F. Campbell.

*** This is done, we understand, at Drury Lane, and it is a right thing to do, but it will not in itself prevent panics, though it may do something to mitigate the results.

PROVINCIAL NEWS.

Bury St. Edmunds.—A new lodge is about to be built at the entrance to the Bury St. Edmunds Grammar School for the Governors. Mr. Frank Whitmore, of Chelmsford, is the architect.

Gallowhill (*Northumberland*). — A large country mansion is in progress at Gallowhill, near Bolam, for Mr. Charles Perkins, J.P. The contractors are Messrs. Joseph Burnett & Son, of Birtley, and the architects are Messrs. Septimus Oswald & Son, of Newcastle-on-Tyne.

Liverpool.—The foundation-stone of the new engineering and technical department of the Liverpool University College was laid on the 1st inst. by the Mayor (Sir James Poole). The want of more accommodation has long been felt, and the architect, Mr. Waterhouse, has been asked to scheme out a building capable of accommodating the main departments of the college, excluding the scientific and technical; his plans have been approved by the council, and sketch plans were exhibited to the public on Saturday. The building, of which the foundation-stone was laid on Saturday, consists of a shaped block resembling the form of the letter L. The long portion of the block forms a room about 100 ft. in length, which is to be a joiner's workshop. The shorter part of the block comprises the laboratory, lecture-hall, and various class-rooms. The longer side of the block faces Brownlow Hill, and has a frontage of 170 ft. The eastern face extends 102 ft., and it is here that the main entrance will be constructed, it being an arched doorway 12 ft. in height, and opening into an entrance hall. The style of the building is Gothic. Upon the ground-floor there will be the joiner's shop. The entrance hall of the other part of the building leads into a large laboratory. Behind the eastern frontage of the building there is to be a boiler-house, in which will be placed the furnaces and boilers necessary to drive the

machinery of the shops, and to work the lift which runs from the ground floor to the top story. The boilers will also supply the hot-water pipes with which the entire buildings are to be heated, pipes extending through all the rooms on each floor. Upon the first floor the chief room is for a museum, the frontage being to Brownlow-hill. The lecture-hall, which is 40 ft. by 34 ft., has seat room for over a hundred students. On the same floor there is an apparatus room, small lecture hall, and rooms for the professor and assistants. A lavatory and two rooms for the accommodation of the porter complete the provision of the first floor. The main part of the second floor is occupied by a large drawing-room. An examining-room and class-room face to the south, and upon this floor are also a superintendent's room, and several small diagram rooms. The height of the main building roof is 60 ft., while a small tower, which rises beyond the rest of the building, reaches 80 ft.

Morpeth.—New business premises are in course of erection in Bridge-street for Alderman G. B. Grey. Mr. James Waterston, mason, and Messrs. G. & C. Haswell, joiners, are the contractors employed. The architects are Messrs. Septimus Oswald & Son, of Newcastle-on-Tyne.

CHURCH-BUILDING NEWS.

Holme-next-Sea.—St. Mary's Church, Holme-next-Sea, which has been closed for the last two months for the purposes of restoration, was re-opened on Sunday, the 25th ult. The work of restoration was commenced about three years since, when the roof, which was in a very dilapidated state, was replaced by a new one. The old-fashioned pews, which were painted in various colours, have now been removed and new open benches substituted. Prayer desks have been placed in the chancel, and a stone pulpit has been presented to the church by Miss Blyth. The works have been carried out by Mr. Southgate, of Hunstanton, under the direction of Mr. William Adams, architect, Lynn.

London.—A new church for the English Presbyterian Congregation was opened on Wednesday, the 5th inst., at Vanbrugh Park, Blackheath. The building consists of a nave, transepts, lecture hall, class-rooms, &c. The exterior is of Kentish Rag and Bath stone, and the whole of the roof, pews, pulpit, reredos, &c., of selected pitch-pine and the outer doors of teak. The tower and spire at the angle of the building towards towards Mycenæ and Vanbrugh Park roads is over 100 ft. high. The site was presented by Mr. Young, a member of the congregation. Mr. Thomas Arnold was the architect and Mr. James Morter, of Stratford, the contractor. The stained glass was executed by Messrs. Pepper & Boyes, the carving by Mr. Allen, the gas pendants by Messrs. Marshall, of Cheltenham, the enclosing fencing by Messrs. Bayliss, and the heating by Messrs. Haden & Son, of Trowbridge.

Over Winchendon (*Bucks*).—The interesting little church of Over Winchendon, near Aylesbury, has recently been re-opened by the Bishop of Oxford, after renovation under the direction of Mr. William White, F.S.A. The plans were prepared some fifteen years ago, but the raising of sufficient funds proved a considerable difficulty and caused much delay in carrying out the work. The chancel is of the period of transition from Norman, with two lancet windows in the east gable and a corbel between them inside, with the string course mitred round it, on which was placed, perhaps, the image of a saint, or, as is thought more likely, a rood. If circumstances should permit, it is proposed to put a large cross here, made of old oak, reaching up to the roof, with a reredos beneath containing a representation of St. Mary and St. John on either side of the base, painted on canopied panels, for which the figures have been already drawn by the architect. In each side wall are three lancets, and on the south a recess, apparently of a priest's door, now blocked on the outside, and immediately westward of this is a low side window, also blocked, of later date. There is a pointed chancel arch of simple or rather of rude construction, and a screen of later date against which new oak "return stalls" have been fixed. It is within memory that the wooden steps to the rood-loft remained. The nave is of Norman date, and in its south wall is a richly-moulded doorway, and one simple window, of Norman date, with a recessed arch inside. The timber porch has been reconstructed as before, but without the plastering. The north door has been opened out; the north aisle is of fourteenth-century date; the windows have flowing tracery. The aisle opens from the nave with two round arches, and one pointed with flat soffits and large rectangular piers evidently cut through the old wall. The chancel fittings are of oak. The old altar and altar-rails have been re-used somewhat altered. Some Mediæval benches have been refixed at the west end. The other benches are made up in deal. They stand on floors of wood block. The passages and the chancel are laid with the old slabs, one containing a good brass made up with tiles.

Shrewsbury.—The dedication of Holy Trinity Church, Belle Vue, Shrewsbury, which has been rebuilt, took place last week. The old church, whose foundations were begun in July, 1836, consisted of a nave 60 ft. by 46 ft., with a flat plaster ceiling 24 ft. high; at the west end was a small tower, under which was the entrance lobby, from this was a staircase leading to a large inconvenient gallery; a very small apse at the east end formed the chancel. A new chancel with side aisles was built in 1861, by the late Mr. S. Pountney Smith, and this is the only portion of the old structure at present standing. The foundation stone of the new nave was laid twelve months ago. The new nave is 87 ft. long by 25 ft. wide, and has north and south aisles 14 ft. 6 in. wide, with arcades of five spans; the nave is lighted by clearstory windows, and is 30 ft. high to the wall-plate. The roofs are all of red deal, boarded and felted on the outside and covered with Sedan green slates. The whole of the work has been carried out in brick, the exterior and interior being faced with Ruabon red pressed bricks, relieved with dressings and bands of Grinshill stone, and the arches of arcades are formed with outer ring of brick and inner ring of stone, the columns being Forest of Dean blue stone, with caps and bases of Grinshill. The levels of the old chancel floor have been altered to suit the new nave, the altar being approached by eight steps. The nave and aisles are seated with low-framed benches of pitch-pine, chairs being placed in the chancel aisles, and also at the west end of the nave, and the north aisle of the chancel will be fitted up for daily services. The choir stalls are of oak, and will accommodate fifty persons. The flooring under all seats is laid with wood blocks, making a noiseless and dry floor; the passages and porches have been laid with plain red tiles, in herring-bone pattern, by Messrs. George Woolliscroft & Son, of Hanley. The encaustic paving of the chancel is the work of Messrs. Minton, Hollins, & Co., of Stoke-on-Trent. A baptistery is formed by a semicircular projection from the west wall of the nave; the roof of this is covered with copper, the floor will be laid in mosaics, and the lower part of the wall will be adorned with fresco painting; the old font, which is of meagre proportion and design, is temporarily refixed, a new one of alabaster having been promised. The organ has been moved to a new position, and rebuilt. The glazing of the windows is in cathedral tinted glass, executed by Mr. John Davies, of Shrewsbury. Ventilation is provided by means of inlets through the aisle walls, and the church is lighted by string-courses of gas jets, both sides of the nave, 21 ft. from the floor, and brackets in the aisles. This work has been carried out by Messrs. Alltree & Lea, of Shrewsbury. The heating has been executed by Messrs. J. L. Bacon & Co., of London, by means of a 1¾-in. iron piping, laid in treaches down the passages of the nave and aisles. A general scheme of subjects for filling the windows of the church with painted glass has been prepared by Messrs. Heaton, Butler, & Bayne. Two of the windows in the aisle have already been filled in by them, and also the five lights in the baptistery. The church will accommodate 822 people, being an increase over the old church of about 340 sittings. The whole of the work has been executed by Mr. Richard Price, builder, Shrewsbury, from the design and under the superintendence of the architects, Messrs. Lloyd Oswell & Pountney Smith, of Shrewsbury. Mr. H. L. Whittingham was the clerk of the works throughout.

Sutton (*Surrey*).—New Christ Church, Sutton, is designed in the Gothic style of the early part of the thirteenth century, and is intended, when complete, to accommodate 1,000 worshippers. The work in the present contract consists of nave, 92 ft. long, 30 ft. wide, and 48 ft. in height from the floor to the semi-circular barrel vaulted ceiling; north and south aisles, of the same length as the nave; chancel; on the north side of the chancel, clergy vestry, choir vestry, organ-chamber, furnace-room, lavatories, &c. Accommodation will thus be afforded for 900 persons, inclusive of the choir. The tower and spire, which will be 160 ft. in height, the northern baptistery, south chapel, and south porch, are intended to be dealt with in a future contract. The materials employed in the construction are local stock bricks for walls, faced internally and externally with local red bricks; Monk's Park Bath stone for columns, caps, and bases of interior and for external weatherings, and Broseley pressed roofing tiles for roof coverings. Internally the floors will be paved with wood blocks, with the exception of the space within the communion-rails, where Broseley pressed tiles of ornamental pattern will be used. The warming is to be effected by means of hot water on the low-pressure system, the pipes being carried under the whole length of aisles, and ventilation is provided for by controllable air inlets through the hot-water pipes and in the sills of windows, and exhaust ventilation through the ceilings. A special feature is made of the organ, the chamber of which is on the north side of the chancel immediately over the choir vestry, with a separate chamber for bellows and blowing-engine, in the basement. The organ manual will be placed on the south side of the chancel adjoining the reading-desk, and will be connected to the organ with pneumatic tubes carried in a tunnel constructed under the floor of chancel. The seating, choir stalls, and most of the furniture and fittings, are included in the present contract, amounting to £6,788, which is being carried out by Messrs. T. Gregory & Co. from the designs of Mr. J. T. Newman, F.R.I.B.A., and Mr. William Jacques, A.R.I.B.A.

STAINED GLASS.

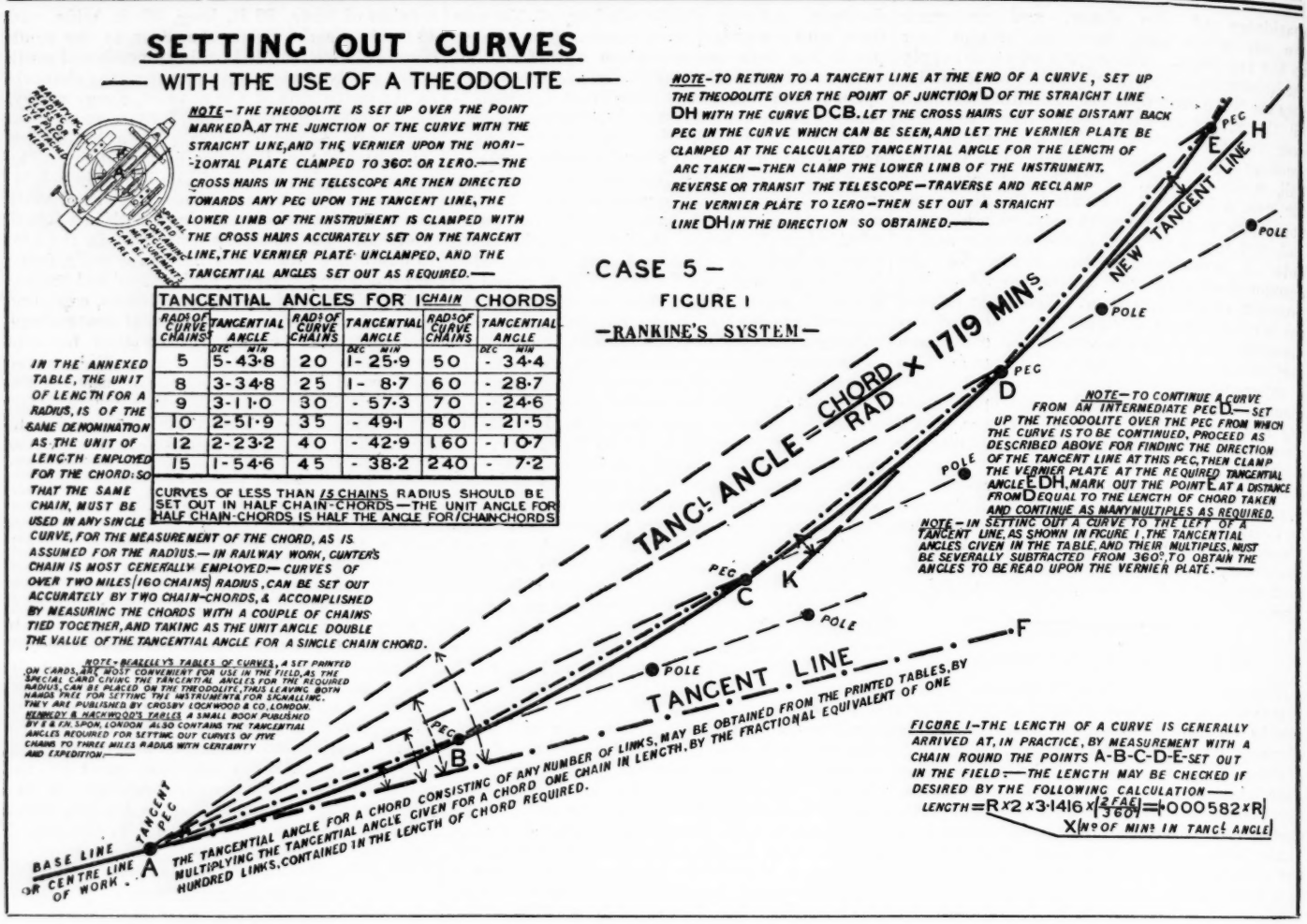
Canterbury.—A large painted window, with subjects of the "Ascension," "Agony in the Garden," &c., and containing the Fagge and Macclesfield arms, has lately been erected in the parish church, Westbere, to the memory of the late Mrs. Parker, wife of Major F. G. S. Parker. The window, which is fourteenth-century in character, has portraits of the deceased lady and her son introduced, and has been designed and executed by Messrs. Chas. Evans & Co., under the supervision of the architect, Mr. E. P. Loftus Brock, F.S.A.

Enderby.—This parish church has lately been further enriched by the addition of a painted Jubilee window with representations of St. George, &c., the work of Messrs. Chas. Evans & Co. An elaborately-engraved brass beneath has the following inscription:—"To the glory of God and in commemoration of the 50th year of the reign of Queen Victoria. Erected by the Congregation. June, 1887."

Preston.—A stained-glass window has recently been placed in St. Wilfrid's Church, Preston, representing figures of St. Elizabeth, St. Peter, and St. Agnes. The work was designed and executed by Messrs. Warrington & Co., of London.

Southampton.—There has recently been erected in St. Luke's Church, Newtown, Southampton, by Mr. Gamlen, of Newtown House, a two-light stained-glass window, in memory of his wife. It contains four scenes from the 10th chapter of St. Mark, relating to the healing of the blind Bartimæus by Christ. The work has been designed and executed by Mayer & Co., of London and Munich.

School of Art Woodcarving.—The School of Art Woodcarving at the City and Guilds Institute, Exhibition-road, South Kensington, has re-opened after the usual summer vacation. To bring the benefits of the school more within the reach of the artisan class a remission of half fees for the evening class is made to artisan students connected with the trade. Instruction is also given by correspondence to amateurs unable to attend the school classes. During the past year the students have been engaged on various architectural and other important works. The public are permitted to visit the school and inspect the work in hand on application to the manager on any weekday except Saturday between the hours of 11 a.m. and 4 p.m.


SETTING OUT CURVES
— WITH THE USE OF A THEODOLITE —
NOTE – THE THEODOLITE IS SET UP OVER THE POINT MARKED A, AT THE JUNCTION OF THE CURVE WITH THE STRAIGHT LINE, AND THE VERNIER UPON THE HORIZONTAL PLATE CLAMPED TO 360° OR ZERO. — THE CROSS HAIRS IN THE TELESCOPE ARE THEN DIRECTED TOWARDS ANY PEG UPON THE TANGENT LINE, THE LOWER LIMB OF THE INSTRUMENT IS CLAMPED WITH THE CROSS HAIRS ACCURATELY SET ON THE TANGENT LINE, THE VERNIER PLATE UNCLAMPED, AND THE TANGENTIAL ANGLES SET OUT AS REQUIRED. —
TANCENTIAL ANGLES FOR 1 CHAIN CHORDS
RADS OF CURVE CHAINS | TANGENTIAL ANGLE DEC MIN | RADS OF CURVE CHAINS | TANGENTIAL ANGLE DEC MIN | RADS OF CURVE CHAINS | TANGENTIAL ANGLE DEC MIN
5 | 5-43·8 | 20 | 1-25·9 | 50 | - 34·4
8 | 3-34·8 | 25 | 1- 8·7 | 60 | - 28·7
9 | 3-11·0 | 30 | - 57·3 | 70 | - 24·6
10 | 2-51·9 | 35 | - 49·1 | 80 | - 21·5
12 | 2-23·2 | 40 | - 42·9 | 160 | - 10·7
15 | 1-54·6 | 45 | - 38·2 | 240 | - 7·2
CURVES OF LESS THAN 15 CHAINS RADIUS SHOULD BE SET OUT IN HALF CHAIN-CHORDS — THE UNIT ANGLE FOR HALF CHAIN-CHORDS IS HALF THE ANGLE FOR 1 CHAIN CHORDS
IN THE ANNEXED TABLE, THE UNIT OF LENGTH FOR A RADIUS, IS OF THE SAME DENOMINATION AS THE UNIT OF LENGTH EMPLOYED FOR THE CHORDS: SO THAT THE SAME CHAIN, MUST BE USED IN ANY SINGLE CURVE, FOR THE MEASUREMENT OF THE CHORD, AS IS ASSUMED FOR THE RADIUS. — IN RAILWAY WORK, GUNTER'S CHAIN IS MOST GENERALLY EMPLOYED. — CURVES OF OVER TWO MILES (160 CHAINS) RADIUS, CAN BE SET OUT ACCURATELY BY TWO CHAIN-CHORDS, & ACCOMPLISHED BY MEASURING THE CHORDS WITH A COUPLE OF CHAINS TIED TOGETHER, AND TAKING AS THE UNIT ANGLE DOUBLE THE VALUE OF THE TANGENTIAL ANGLE FOR A SINGLE CHAIN CHORD.
NOTE – BEAZELEY'S TABLES OF CURVES, A SET PRINTED ON CARDS, ARE MOST CONVENIENT FOR USE IN THE FIELD, AS THE SPECIAL CARD GIVING THE TANGENTIAL ANGLES FOR THE REQUIRED RADIUS, CAN BE PLACED ON THE THEODOLITE, THUS LEAVING BOTH HANDS FREE FOR SETTING THE INSTRUMENT. FOR SCALE ETC. THEY ARE PUBLISHED BY CROSBY LOCKWOOD & CO., LONDON.
KEARLEY & HACKWOOD'S TABLES A SMALL BOOK PUBLISHED BY E & F.N. SPON, LONDON ALSO CONTAINS THE TANGENTIAL ANGLES REQUIRED FOR SETTING OUT CURVES OF FIVE CHAINS TO THREE MILES RADIUS WITH CERTAINTY AND EXPEDITION. —
NOTE – TO RETURN TO A TANGENT LINE AT THE END OF A CURVE, SET UP THE THEODOLITE OVER THE POINT OF JUNCTION D OF THE STRAIGHT LINE DH WITH THE CURVE DCB. LET THE CROSS HAIRS CUT SOME DISTANT BACK PEG IN THE CURVE WHICH CAN BE SEEN, AND LET THE VERNIER PLATE BE CLAMPED AT THE CALCULATED TANGENTIAL ANGLE FOR THE LENGTH OF ARC TAKEN — THEN CLAMP THE LOWER LIMB OF THE INSTRUMENT, REVERSE OR TRANSIT THE TELESCOPE — TRAVERSE AND RECLAMP THE VERNIER PLATE TO ZERO — THEN SET OUT A STRAIGHT LINE DH IN THE DIRECTION SO OBTAINED. —
CASE 5 —
FIGURE 1
— RANKINE'S SYSTEM —
TANG^L ANGLE = CHORD / RAD x 1719 MINS.
NOTE — TO CONTINUE A CURVE FROM AN INTERMEDIATE PEG D. — SET UP THE THEODOLITE OVER THE PEG FROM WHICH THE CURVE IS TO BE CONTINUED, PROCEED AS DESCRIBED ABOVE FOR FINDING THE DIRECTION OF THE TANGENT LINE AT THIS PEG, THEN CLAMP THE VERNIER PLATE AT THE REQUIRED TANGENTIAL ANGLE E D H, MARK OUT THE POINT E AT A DISTANCE FROM D EQUAL TO THE LENGTH OF CHORD TAKEN AND CONTINUE AS MANY MULTIPLES AS REQUIRED.
NOTE – IN SETTING OUT A CURVE TO THE LEFT OF A TANGENT LINE, AS SHOWN IN FIGURE 1, THE TANGENTIAL ANGLES GIVEN IN THE TABLE, AND THEIR MULTIPLES, MUST BE SEVERALLY SUBTRACTED FROM 360°, TO OBTAIN THE ANGLES TO BE READ UPON THE VERNIER PLATE. —
NEW TANGENT LINE
TANGENT LINE
BASE LINE OR CENTRE LINE OF WORK
TANGENT PEG
PEG
POLE
A
B
C
D
E
F
H
K
THE TANGENTIAL ANGLE FOR A CHORD CONSISTING OF ANY NUMBER OF LINKS, MAY BE OBTAINED FROM THE PRINTED TABLES, BY MULTIPLYING THE TANGENTIAL ANGLE GIVEN FOR A CHORD ONE CHAIN IN LENGTH, BY THE FRACTIONAL EQUIVALENT OF ONE HUNDRED LINKS, CONTAINED IN THE LENGTH OF CHORD REQUIRED.
FIGURE 1 – THE LENGTH OF A CURVE IS GENERALLY ARRIVED AT, IN PRACTICE, BY MEASUREMENT WITH A CHAIN ROUND THE POINTS A-B-C-D-E- SET OUT IN THE FIELD: — THE LENGTH MAY BE CHECKED IF DESIRED BY THE FOLLOWING CALCULATION —
LENGTH = R x 2 x 3·1416 x [2 FAE / 360] = ·000582 x R x (No OF MINS IN TANG^L ANGLE)

The Student's Column.

LAND SURVEYING AND LEVELLING.

XV.—SETTING OUT CURVES.

Case 5 illustrates the best method for setting out curves of very large radii, and is based upon the fact proved in Case 1, that at any portion of a circular curve, the angle subtended by an arc of a fixed length is constantly the same, no matter in what part of the curve the arc or distance be taken, and the angle subtended by any other distance is proportional to that distance. To apply this principle in practice, the late Professor Rankine suggested the measurement of a chord line, which should be taken in comparative short lengths, so as to be practically equal to the length of the curved line adjacent to the length of chord. An accurate circle might thus be completely set out the same as a polygon of an infinite number of sides; but in practice, so long as the length of the curve line is not more than one link greater than the length of chord, the method is accurate. Referring to fig. 1 it will be seen that the length of the chord A B is practically equal to the length of the curve A B, but the length of the chord A C is less than the length of the curve A B C, and the length of the chord A E is very much less than the length of the curve A B C D E.

The length of a chord line which subtends an angle of 60 degrees at the centre of a circle is equal to the radius; but the length of an arc or curve equal to the radius subtends an angle at the centre of the circle of 57·29 degrees. For a radius of two miles (160 chains) it will be found that the length of a chord of two chains is approximately equal to the length of the curve it connects, but that for a radius of less than one-tenth of this distance (16 chains) it is advisable to take half-chain chords. For curves of less than 5 chains (330 ft.) radius, the arc subtending an angle of 60 degrees at the centre of the circle is so soon approached, and the length of chords to be measured would be so small, that the method shown in Case 3 will furnish the best curve. On the other hand, when Case 3 is applied to curves of over 5 chains radius, the length of the tangent lines from their point of intersection to the commencement and end of the curve is so long, while the perpendicular offsets become so short, that the method explained by Case 5, with the use of a theodolite for setting out the tangential angles, is more advisable.

A very convenient list of tangential angles multiples for curves, from 5 to 200 radius, and has been compiled by Mr. Alexander Beazeley, M.Inst.C.E., and is published as a set, printed on card, for use in the field. The special card, giving the required tangential angles for any required radius, can be placed on the theodolite in one of the clip spring pieces which are intended to hold the magnifying-glass for the reading of the vernier. The angles marked upon the card are calculated from the formula given in Case 1, namely, "Angle in minutes equals the chord divided by radius when the result is multiplied by 1719." This angle is set out with the use of the opposite vernier, as indicated by the small sketch of the plan of a theodolite at the top of our diagram.

We give a copy of the figures upon one of these cards as an illustration:—

Radius 20.

	°	′	°	′
1	1	26	358	34
2	2	52	357	8
3	4	17⅔	355	42⅓
4	5	43⅔	354	16⅓
5	7	9⅔	352	50⅓
6	8	35⅔	351	24⅓
7	10	1⅔	349	58⅓
8	11	27⅔	348	32⅓
9	12	53⅔	347	6⅔
10	14	19⅓	345	40⅔

Multiples for 20 *Rad.*

1	85·94367
2	171·88734
3	257·83101
4	343·77468
5	429·71835
6	515·66202
7	601·60569
8	687·54936
9	773·49302

With the use of a book containing the angles required, the angle is read, and the book placed away in the pocket, so as to leave both hands free for setting the instrument; but with the use of a card temporarily fixed upon the theodolite the angles to be set out are constantly under inspection.

Nineteenth Century Art Society.—Monday, the 10th inst., has been appointed for the reception of works of art intended for the Autumn Exhibition of the Nineteenth Century Art Society, at the Conduit-street Galleries.

VARIORUM.

Messrs. Crosby, Lockwood, & Son have sent us their list of books for the forthcoming season. The list includes "A Dictionary of Terms used in the Practice of Mechanical Engineering: comprising upwards of 6,000 definitions," compiled and edited by the author of "Pattern Making"; "Practical Surveying: a Textbook for Students preparing for Examinations or the Colonies," by George W. Usill, A.M.I.C.E., author of "The Statistics of the Water-supply of Great Britain"; "Marble and Marble Workers: A Handbook for Architects, Artists, Masons, and Students," by Arthur Lee, author of "A Visit to Carrara," "The Working of Marble," &c.; "Our Granite Industries," by G. F. Harris, F.G.S.; "Tables, Memoranda, and Calculated Results for Mechanics, Engineers, Architects, Builders, Surveyors, &c.," selected and arranged by Francis Smith, fourth edition; "Lockwood's Builder's and Contractor's Price Book for 1888, containing the latest prices of materials and labour in all trades connected with building," edited by F. T. W. Miller, A.R.I.B.A.; and "House Painting, Graining, Marbling, and Sign Writing, with a Course of Elementary Drawing, and a Collection of useful Receipts," by Ellis A. Davidson, fifth edition, with coloured plates.——Mr. B. T. Batsford, of 52, High Holborn, has sent us his new catalogue of new and second-hand books on Civil and Mechanical Engineering, Geology, Electricity, and many other scientific subjects. The catalogue will repay perusal, as it includes a large number of standard works "without which no [technical] library is complete."——"Shorthand Celebrities of the Past," by Edward Pocknell, Past-President of the Shorthand Society, illustrated by twenty-two portraits drawn by Arthur Frederics (London: James Wade, 18, Tavistock-street, Covent-garden), is an interesting and timely *souvenir* of the recent very successful International Shorthand Congress held in London. The text consists of short biographies of twenty-eight "celebrities," from Trithemius, or Trittenheim, Abbot of Spanheim (1483-1506), down to James Henry Lewis (1786-1853). The list of shorthand worthies thus treated of includes John Jewell (1522-1571), Bishop of Salisbury; Dr. Timothy Bright, whose tercentenary was one of the events celebrated by the recent Congress; John Byrom, F.R.S. (1691-1763); and Thomas

Gurney (1705-1770), whose history is somewhat remarkable. While shorthand now plays a very important part in the work of the world, there are many who believe that it is as yet in its infancy, though it has made great strides within the last fifty years, owing mainly to the labours of Mr. Isaac Pitman, the inventor of phonography, who has lived to see the jubilee of the introduction of his system of shorthand, —an event which was marked during the Congress by the presentation to his family of his bust, an admirable portrait-bust from the chisel of Mr. Brock. It is satisfactory to see that *pari passu* with the practical use of the art, the literature and what may be called the archæology of shorthand are not being neglected, for besides Mr. Pocknell there are other workers in this field, most notably Dr. Westby-Gibson, who has just published his "Bibliography of Shorthand."

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

11,121, Window Fastenings. H. S. Harris.

At the top ledge of the lower sash of an ordinary window, a plate of brass, having two sides fixed at right angles to it, is placed; a lever is secured between these sides by means of a pin running through it and the aforesaid sides. Fastened to the plate at one end of the lever, is a spiral spring, and over the same end of the lever is a pin or small piece of metal, which keeps the lever in position, ready for use. To the lower ledge is affixed a catch. With this apparatus, the window being closed, the end of the lever and the catch meet and lock automatically, rendering it impossible for the window to be closed without being secured. It cannot, moreover, be opened from the outside. When opening the window it is only necessary to press the end of the lever, thereby depressing the spring and unlocking the casement.

13,597, Fall Pipes, &c. J. Parsons.

One end of the fall-pipes or pipes used for various purposes, as soil-pipes, waste-pipes, rain-water pipes, &c., are made with one end slightly narrowed or contracted, and on the other end is a socket to correspond with the tapered end. When two pipes are connected, the jointing substance is compressed by the weight of the pipe above it, and a solid joint is effected. The method of fastening is also improved, nails or spikes being driven into the wall at an acute angle, and thus holding the pipes without the necessity of cutting plug-holes in the brickwork.

17,119, Trapping Drains and Sewers. P. F. Richards.

A trap having on the intake side a floating ball of copper, supported on a curved dip, forming the water seal, with a clear water-way round the curved dip, is the improved form. On the tide or other waters rising on the outgo side of the trap, the water in the trap rises and so floats the ball and blocks it against the intake of the trap, and on the falling of the ball the trap again comes into action.

12,330, Waste-Preventing Cisterns. J. J. Tylor.

The improvement is in stamping the cisterns, which are known as "two-gallon waste-preventing cisterns," out of one piece, care being taken to anneal the iron after each different stamping operation.

13,537, Improved Flushing Apparatus. D. Lyon.

The idea is to raise water by partial vacuum over and into the top of a trapped outlet, the top of which is at least 2½ in. above the standing level of water in the cistern on the discharge of the water syphonage ensues without the employment of valves or tight-fitting parts. The specification describes the mechanism for this purpose.

5,280, Fixing Roofing Sheets. C. J. Latter.

A forked piece of metal is employed in combination with the double or folded edged roll caps securing the roll cap to the roof by sliding into the holding-down clips before described. A saddle-piece is also fitted to the flanged end of the roll cap in such manner that when used against a drip or wall, the same is a perfectly water-tight joint.

9,966, Bolts for Doors. A. E. Earl.

The object is increased safety, and consists in passing a pin through a hole in an ordinary bolt, so that when the bolt is shot forward it cannot be pushed back without first removing the pin.

NEW APPLICATIONS FOR PATENTS.

Sept. 23.—12,893, S. Harrison, Testing Gas Pipes and Fittings.—12,906, T. Murphy, Compressed Air Door Regulators.—12,919, A. Wells, Revolving Wood Shutters.

Sept. 24.—12,935, J. Macmeikan, Wind Guards and Ventilators.—12,975, W. Horn, Door Latch.

Sept. 26.—12,979, A. Knevett, Domestic Fire-grates.—12,991, W. Murray, Gates.—13,011, W. Jones, Pipe Cutters.—13,018, R. Prowse and D. Doig, Sliding Windows, &c.—13,022, J. Carey, Roofing Tiles, &c.—13,025, J. Fisher and L. Booth, Fireproof Curtains or Screens for Theatres and other Public Buildings.

Sept. 27.—13,065, E. Weldon, attaching the Blades of Saws to Handles.

Sept. 28.—13,110, A. Harris and J. Hannay, Fireproof Theatre Curtains.—13,111, S. Bennett, Hoists or Lifts.—13,127, A. Stephenson, Butt-hinge and Method of Fixing same to Doors.—13,161, S. Huntley, Devices for Facilitating the Cleaning of Drains, &c.

Sept. 29.—13,180, J. Hargreaves, Manufacture of Cement.—13,193, J. & T. Stanley, Preventing the Spread of Fire in Theatres, &c.—13,207, A. Morley and H. Wilson, Indicators for Electric Bells.

PROVISIONAL SPECIFICATIONS ACCEPTED.

11,068, J. Speakman, Paint Restorers and Removers.—11,334, A. and R. Knox, Wood Planing Machines.—11,434, O. Elphick, Syphon Cisterns.—11,438, J. Cantle, Fireproof Holders for Joists for Party Walls.—11,587, J. Holt, Latches and Bolts for Doors, &c.—11,703, A. Rose and R. Hunter, Safety Fasteners for Window-sashes.—11,745, W. Ormrod, Self-lubricating Mould for Brickmaking Machines.—11,772, S. Spencer, Window Fastening.—11,829, W. Crozier, Locking Sash Fastener.—12,034, A. Ledger, Drawing-boards and T Squares.—12,279, E. Williams and J. Morgan, Fire-grates.—10,950, J. Bean and W. Gaines, Closing Doors and Preventing the Slamming of Same.—11,410, J. Reid, Rendering Doors, Windows, Casements, &c. Air-tight or Draught-proof.—11,833, R. Herrmann, Wall-papers, &c.—11,937, J. Homan, Fireproof Floors.—11,961, B. Turner, Door Springs.—12,014, G. Brewer, Automatic Apparatus for Closing Doors.—12,052, W. and S. Denham, "Filler" for French Polishing.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

12,463, F. Prouvay, Saws.—12,374, W. Buchan, Ventilators.—15,493, J. Shanks, Lavatories or Wash-hand Basins.—16.612, C. Harris, Gas Chandeliers, Gaseliers, and Brackets.—1,463, B. Bancroft, Automatically Closing Doors, &c.—1,493, J. and J. Wilson, Curing Smoky Chimneys.—9,122, J. Lowe, White Lead.—10,236, C. Gregson, Concrete Walls, &c.—14,580, H. Perry, Machine for Sizing and Varnishing Paper-hangings.—15,386, A. Illidge, Indicator Bolts for Doors.—15,584, P. Walker, Ventilators.—3,488, S. Hill, Door-spring.—4,001, E. Ledger, Shop Window-fittings.—9,187, A. Reichert and G. Yingling, Sawing Machine.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

SEPTEMBER 26.

By Mr. Woods.

Blandford-square—20 and 21, Byron-street, 54 years, ground-rent 7*l.* 10s.	£290

By Baker & Sons (at Cromer).

Norfolk, Cromer—142 plots of freehold land	3,060

SEPTEMBER 27.

By E. Robins & Hine.

Dalston—Ground-rents of 39*l.* a year, term 30 years	490

By H. Haines & Son.

Holloway—Improved ground-rents of 132*l.* 10s., term 21 years	1,000

By P. Hodson.

Crouch Hill—166, Stroud Green-road, 88 years, ground-rent 8*l.* 8s.	450

By W. A. Blakemore.

Brixton—23, Holland-road, 37 years, ground-rent 4*l.* 10s.	200
Westminster—3, Roehampton-street, 39 years, ground-rent 10*l.*	465

By Fuller & Fuller.

Upper Clapton—Ground-rents of 48*l.*, reversion in 94 years	1,310
Mount Pleasant-lane, Moreton Lodge, freehold	2,110
Ground-rents of 43*l.*, term 16 years	410

By T. Bannister (at Hayward's Heath).

Hayward's Heath (near)—Hanlye Farm, containing 158a. 3r. 13p., freehold	5,400
Part of Gravelye Farm, 39a. 1r. 4p., freehold	1,800

SEPTEMBER 28.

By Marler & Bennett.

Battersea—86, Castle-street, 90 years, ground-rent 5*l.* 5s.	240
Nos. 55, 57, 59, and 61, Inworth-street, 90 years, ground-rent 20*l.*	660
West Brompton—16, 18, and 20, Colherne-street, 77 years, ground-rent 37*l.* 10s.	2,160
South Kensington—5, Station-buildings, 14 years, ground-rent 15*l.*	150

SEPTEMBER 29.

By J. Lees.

Mickleham—A pair of copyhold cottages	340
Copyhold business premises and goodwill	730
Four cottages and a plot of land, part freehold and part copyhold	980

By J. G. Prevost.

Leytonstone-road—Two plots of freehold land	80
Mile End—32 to 40, even, Ernest-street, freehold	990
Limehouse—65 and 67, Church-row, freehold	195
Mile End—121 and 127, St. Paul's-road, 88 years, ground-rent 5*l.*	455
No. 5, Gold-street, 36 years, ground-rent 2*l.* 17s. 6d.	215

By H. A. Henderson.

Dalston—102, Norfolk-road, 74 years, ground-rent 5*l.*	£350
Hackney—32, Avenue-road, freehold	375

By E. Stimson.

South Lambeth-road—22 and 23, Thorne-road, 74 years, ground-rent 10*l.*	640
Peckham, Queen's-road—Lime Cottage, 27 years, ground-rent 5*l.*	150
Peckham Rye—No. 198, St. Ann's Lodge, 26 years, ground-rent 15*l.*	500
Kentish Town—5 and 6, Clarence-grove, 41 years, ground-rent 8*l.* 10s.	435
City—The lease and goodwill of 33, Bishopsgate-street Without, term 16 years	740
Southwark—5, Merrick-square, 38 years, ground-rent 5*l.*	450
Wandsworth—10 to 22, even, Edmund-street, 65 years, ground-rent 24*l.* 10s.	500

SEPTEMBER 30.

By C. & H. White.

Brixton, Elliot-road—Langton Lodge and Langton Villa, 70 years, ground-rent 4*l.*	360
Old Kent-road—2 and 4, Unwin-road, 95 years, ground-rent 24*l.*	55

MEETINGS.

TUESDAY, OCTOBER 11.

Parkes Museum (*Lectures for Sanitary Inspectors*).—Mr. J. Gordon, on "Scavenging, Disposal of Refuse and Sewage." 8 p.m.

FRIDAY, OCTOBER 14.

Parkes Museum (*Lectures for Sanitary Inspectors*).—Professor W. H. Corfield, M.A., M.D., on "Sanitary Appliances." 8 p.m.

Miscellanea.

The Water Supply of Tottenham.—Having regard tothe very rapid development of the district under their jurisdiction, the Tottenham Local Board of Health are making important extensions to their system of water supply. The works include an artesian well at the Longwater pumping station, 12 ft. in diameter down to the chalk, and carried by a 24-in. boring in the chalk to a depth of 450 ft. from the surface; two 50-horse-power engines, pumps, boilers, water-tower, and engine-house. The scheme has been designed by Mr. W. A. H. De Pape, Chief Waterworks Engineer, and the operations are being conducted under his personal superintendence. Mr. W. Brown, of Tottenham, is the contractor for sinking the well; Messrs. Wood Bros., of Sowerby Bridge, for making the engines; and Messrs. Wilkinson Bros. for erecting the buildings. The works recently constructed from Mr. De Pape's plans comprise large reservoirs and a water-tower at Mount Pleasant. The entire scheme will evolve an outlay of 25,000*l.*, and when it is completed Tottenham will occupy a very favourable position in respect to its water supply as compared with many other districts adjacent to London. As to quality, it is stated that the water which is obtained from the chalk stands nearly equal to Kent and Colne Valley in the analytical reports of Dr. Frankland to the Registrar-General. A singular feature in connexion with the sinking of the well is the variation in actual strata from those shown by the trial boring: in one instance a layer of limestone rock, 15 ft. thick, being met with, the substance having previously been entirely unknown in the district.

The Edinburgh Theatres.—The *Scotsman* says that the Burgh Engineer and Firemaster have completed a portion of their report on the condition of the Edinburgh theatres, and the remainder, which is in progress, is expected to be ready at an early date. The part prepared deals with the Lyceum Theatre and Newsome's Circus, and bears evidence of a close examination having been made into both houses. The strictures passed on the circus are now, of course, of little account, the building having been burned to the ground, but the result of the inspection of the Lyceum will be made the subject of mature deliberation. It is understood that in respect to this theatre several recommendations with the view to further insuring the public safety are made. While on this subject, we may mention that it is said to be the intention of Mr. and Madame Newsome to rebuild their circus in Nicolson-street, Edinburgh, as soon as matters are settled with the insurance company.

Brussels.—A new National Theatre is being built in Brussels. When completed it will be the largest and finest theatre in the country, and is to be named the Flemish Theatre. For the ventilation Messrs. Robert Boyle & Son's system has been adopted, the extraction of the vitiated air being effected by the latest improved form of the air-pump ventilator.

Liverpool Engineering Society. — The usual fortnightly meetings of this Society were resumed at the Royal Institution, Colquitt-street, on Wednesday, October 5th, Mr. John J. Webster, M.Inst. C.E., President, in the chair. A paper was read by Mr. F. Huddleston, M.Inst. C.E., on the Coaling Appliances of the Port of Liverpool. The coal annually shipped at Liverpool, Birkenhead, and Garston is rather more than three million tons; from 600,000 to 650,000 tons is exported to foreign parts, most of the rest being used as bunker coal. The Liverpool High Level Coal Railway at the Wellington and Bramley-Moore Docks was opened for use in 1856, and in 1884 the accommodation was doubled. The appliances consist of nine hydraulic cranes, with powers varying from 10½ to 24 tons, used to load vessels of all classes, and one balance-tip for loading flats. The traffic at the present time is carried on by means of locomotives and hydraulic capstans, but up to the year 1884 horses only were used. The level of the railway is about 21 ft. above the quay, the space beneath it being made use of as sheds, &c., and there is no interference with the ordinary traffic to and from the docks. The coal shipped is from the north-west and south-west coalfields of Lancashire, and is brought down by the Lancashire and Yorkshire Railway Company, who provide extensive sidings at Sandhills. The Birkenhead appliances consist of three hydraulic hoists and seven low-level balance-tips in the east and west floats. The hoists are used for vessels of large size, while the balance-tips put bunker coal into flats, which are afterwards taken alongside the steamships in the various docks; about 200,000 tons of South Wales coal is shipped yearly at Birkenhead for bunker use. The shunting at the tips is done by horses. The sidings for coal wagons are at the Cavendish Wharf. Liverpool and Birkenhead together ship two million tons per annum. At the North-Western Railway Company's Docks, at Garston, there are eight vertical drop-balance-tips worked from a high level and fed by hydraulic capstans. These ship annually rather over one million tons of coal from South-West Lancashire, the greater part of which probably goes coastwise.

The German Screw Industry. — The manufacture of screws in Germany is chiefly centred at Berlin, where screws are now made in such quantities and of such qualities that these products are esteemed not only in Germany, but in other countries. The principal manufacture is that of fine screws worked bright, from the larger sizes for machinery, down to the smaller kinds for watch-work, &c., the materials employed being iron, steel, brass, German silver, &c. Efforts are now being made to increase the production of rough black screws for ordinary wood and ironwork. This class of screws has hitherto been principally made in Westphalia, but the development of screw-making machinery which will take the place of hand labour, in Berlin will, it is considered, cause a great change. There are in the Westphalian district, near Hagen, fifteen screw manufactories, employing in all about 3,000 workpeople. The Berlin industry comprises twenty-eight factories, with about 1,500 workpeople. As these are, however, almost exclusively engaged in the manufacture of screws, while at the various establishments near Hagen only about one-third of the workpeople are employed in this particular industry, it is claimed that Berlin is at least as important a seat of screw manufacture as the Hagen district. Berlin used at one time to draw its supplies of raw material almost entirely from Westphalia, but of late years the constantly increasing employment of ingot steel instead of finished iron, has developed the use of Brunswick raw material, from Peine, which is cheaper than the Westphalian product, owing to the shorter railway journey it has to make. Steam machinery is exclusively employed for making bright screws, one factory having lately erected a new steam-engine of 45 horse-power. The screw-making machines in use are upon a system invented by Kernaul some thirty-five years ago, but which has since been much improved. The manufacture of these screw-making machines constitutes a special branch of Berlin industry. The introduction of new automatic machinery will, it is expected, lead to a further development of the manufacture of screws, more particularly in connexion with the making of nuts for the larger sizes of machine bolts. The history of the Berlin screw manufacture is considered to disprove the assertion that an important metal article can only be made in the immediate vicinity of the works where the raw material is produced. This result is attributed to the intelligence and skill of the Berlin workmen.—*Iron.*

Electric Wire Casings. — Mr. Samuel Elliott, of Newbury, has sent us his book of designs and sections for moulded wood casings and covers for electric wires, many of which are of new design. Architects and others concerned for buildings in which electric lighting is used will find it worth while to obtain this catalogue.

Sanitary Appliances. — Messrs. Thos. Crapper & Co., of Marlborough-road, Chelsea, have sent us a copy of their illustrated catalogue of sanitary appliances, and we have recently had an opportunity of inspecting at the works some of the items shown in it. Their improved fittings for baths are very simple; each valve is separate, and can be easily disconnected. Some good closet apparatus are on the list; of these we may specially mention the "Elastic Valve-Closet," No. 2, which has a special rim to prevent the escape of water over it. A cheaper apparatus is the "Marlborough" closet, which is of the pedestal type, in one piece of earthenware. Messrs. Crapper & Co. also make a very good syphon water-waste preventer, fitted with tranquil pipe for deadening the sound of filling. We might make a long list of commendable things to be found in the catalogue, but we conclude by mentioning Messrs. Crapper's excellent air-tight frames and covers for manholes, side entrances to drains, &c. The covers are not hinged to the frames, so can readily be removed when necessary, so as to allow full access to the manhole or entrance.

The Middlesex Hospital.—The new buildings, which have been in course of erection for the past twelve months, were opened on Monday by the Lord Mayor. The Trained Nurses' Institute is a plain substantial building, erected on the lines of the adjoining Nurses' Home, and affords accommodation for twenty-four trained nurses, including sitting-room, bath-rooms, office, store and linen-rooms. A door is formed in the division wall on each floor, giving access to the home and the hospital, on the basement floor a large dining-hall has been built, and is connected to the existing refectory. The kitchen has been enlarged, and is fitted up with gas ovens, steam closet, boiling coppers, &c. The heating is by steam coils, and the ventilation is by Verity's patent waterspray tubes, with a large exhaust cowl on top. The Residential College is a large building, erected for the accommodation of the medical students practising at the hospital; it contains separate apartments for thirty-three students, with the warden's bed and sitting-room, bath-rooms, and box-room. On the ground-floor is a large dining-hall, a common room, and a study or reading-room. The entrance is from Cleveland-street, and opens into a spacious entrance-hall; another entrance is from the hospital garden. The basement contains stewards' rooms, kitchen, scullery, stores, and servants' rooms. The front is built of stock bricks, with red brick dressings, the cornices being in moulded red bricks to match. The garden front is of a more ornamental character, being built of red bricks with buff-coloured terra-cotta dressings. There are four tiers of bay windows, with casements and fanlights. A porch entrance is here added with ornamental iron gates, and railings on each side to match. In addition to the present medical school buildings, another large building has been added, giving a lecture theatre, physiological class-room, laboratory, library, students' and luncheon-room. These are approached by a fireproof staircase constructed in a wing adjoining, openings being made in the walls, giving access to the rooms on the several floors. The entrance is from Cleveland-street, with another entrance from the Hospital garden. The entrance-hall and corridors are paved with Ebner's polished marble concrete, Hyatt's prismatic lens lights being used to give additional light to the lavatories below. The whole of these buildings, as also the museum, is heated by hot-water pipes and coils. The library and lecture theatre are lighted by Wenham lamps, the other gasfittings being of the ordinary kind. In the hospital considerable additions and alterations have been made; the old steam boiler has been replaced by a new one of the marine multitubular type: this is made of steel plates, and is worked at a pressure of 80 lb. on the square inch; a Bradford's large size hydro extractor, and a large size washing machine have been added, also a 4-ft. Blackman's air-propeller; two sets of drying houses heated by 4-in. steam pipes were also necessary to meet the increased demands on this portion of the work. The hospital kitchen has been fitted with modern cooking appliances, all of which were supplied and fixed by Messrs. Slater & Co., of High Holborn. The terra cotta was supplied by Messrs. Wilcock & Co., of Burmantofts, Leeds, 2,097 pieces being made and delivered in seven weeks. The iron railings are by Richardson, Ellson, & Co. The stoves, chimney-pieces, and tile hearths from Thos. Elsley, of Great Portland-street. The locks and furniture were made to master keys, by Charles Smith & Sons, of Birmingham. The furnishing is by Shoolbred & Co. The fittings and sanitary appliances are from Messrs. Dent & Hellyer, of Newcastle-street, Strand. Messrs. Holland & Hannen were the contractors, Mr. Beal being their foreman of works. Mr. Keith D. Young is the architect, and Mr. Thomas Gamage the clerk of works.

English Machinery for America.—We have previously had occasion to record the manufacture of some splendid specimens of the roll casters' and roll turners' art in South Staffordshire, for use in linoleum mills. Hitherto the rolls have been mainly for Scotch mills. Now, however, the United States have come to this country for a complete machine plant for linoleum mills, weighing altogether some 300 tons. The whole work is in the hands of a Gloucester millwright, and the rolls have been supplied from the West Bromwich locality. Three very fine rolls have been despatched, weighing respectively about 13 tons, 20 tons, and 24 tons, and the turning of the same in the lathe has been accomplished very successfully. The work is quite a triumph of the engineer's craft, and deserves special mention. The rolls are made with a hollow core through the centre, through which, in operating on the linoleum manufacture, a jet of steam is constantly kept passing to keep the rolls warm. The more importance attaches to the contract since the American buyers intimate that if the plant when erected is found to work satisfactorily, a duplicate order may probably be placed.—*Engineer.*

A Year's Building Operations in Glasgow.—At a meeting of the Glasgow Dean of Guild Court the other day, Lord Dean of Guild Blackie submitted a summary of the year's transactions of the Court. During the twelve months ending 31st August last the number of linings granted was 238, being an excess of 38 beyond the numbers of the previous year. The excess was wholly due to an increased number applicable to churches, halls, and schools, warehouses, stores, &c., and to alterations and additions. Those applicable to shops, 39 in all, were fewer by three than those of the previous year. These 39 linings comprised 1,028 houses and 79 shops, as compared with 1,262 houses and 52 shops in the previous year. The aggregate value of the property included in the 238 linings was estimated at 424,730*l.*, as compared with 394,540*l.* in the preceding year. The excess was due to the increase under the four headings of "public buildings," "churches, halls, &c.," "warehouses, stores, &c.," "alterations and additions," which amounted to 250,280*l.*, as against 186,490*l.* in the previous year. On the other hand, dwelling-houses and shops had decreased from 208,050*l.* in the preceding year to 174,450*l.* Comparing the amount of business transacted in the Court five years ago, he said that in 1883 dwelling-houses figured to the amount of only 88,650*l.*, and had risen in 1887 to 174,450*l.*; warehouses, stores, and workshops, which in 1883 stood at 291,461*l.*, were in the past year registered at only 73,100*l.* Churches, halls, and schools had during the same period risen from 35,500*l.* to 63,200*l.*, and alterations and additions had decreased from 71,670*l.* to 58,930*l.* These figures, he said, did not seem to indicate any marked revival in the local building trades, but possibly, looking to the fact of the area of the municipality being a fixed quantity, and now presenting a comparatively fixed space for the erection of new buildings, the figures he had quoted might be susceptible of a more encouraging interpretation than he had felt at liberty to put upon them.

The Obelisk in Central Park, New York. Although it was stated a year ago, as recorded in the *Builder* of October 2nd, 1886, that the Egyptian obelisk in Central Park, New York, had not been so thoroughly protected by the hot paraffin treatment it received in the autumn of 1885 as was expected, a second year's experience somewhat modifies that statement. The obelisk has just been examined again, and the result of the examination is to the effect that the treatment has been useful as a preventive of further scaling from the action of frost. This would seem to prove that the effects of the preservative process adopted only begin to show themselves after a lapse of time.

Peterhead.—Messrs. D. Macandrew & Co., of Aberdeen, whose offer was accepted (in October last year) for the erection of the various structures comprising the prison and accessories for the accommodation of the convicts to be employed in the construction of the Harbour of Refuge at Peterhead, have been pushing the work forward with great expedition. The governor's house, offices and stores, bachelor officers' quarters, warders' quarters, kitchen, baths and washhouses, and infirmary, are all slated, and the plasterers progressing rapidly inside. The mason work of the gatehouse and refractory cell block will be completed by the end of this month (October). The cell block is 156 ft. 10 in. long by 40 ft. wide, four stories in height, and built entirely of cement concrete. A spacious corridor, 18 ft. wide, runs the entire length of the building, and extends to the full height of the block, viz., 45 ft. The cells are ranged on each side of this corridor, twenty-six on each side, fifty-two on each floor, or 208 in all. Three tiers of galleries are carried round the corridor at the levels of the first, second, and third floors respectively, being reached by one main central iron staircase. Each cell is separately ventilated. All the other buildings are of rubble granite masonry of the dull red colour of the well-known Peterhead granite. The door and window lintels, quoins, plinths, string and cornice courses, chimney copings, and other dressings are moulded of cement concrete and polished by hand, giving the appearance of freestone, looking exceedingly well and in harmony with the red granite. Even in a locality where granite is so abundant and so easily obtained as at Peterhead, the Prison Commissioners have saved nearly 2,000*l.* by the adoption of concrete dressings. The whole of the cell blocks will be heated by powerful hot-air stoves. The prison will be lighted with gas supplied by the Corporation of Peterhead. The site of the prison is on a clay bank, 40 ft. or 50 ft. above the level of the sea just adjoining; and the whole of the buildings will be drained by means of glazed tile-ware pipes discharging into the sea. The prison works are expected to be finished in May next year, and the total cost will amount to 31,000*l.* The buildings are designed by the official architects of H.M.'s Prison Commissioners for Scotland, and are being carried out under the superintendence of Major McHardy, the Acting Commissioner. Mr. Alford is surveyor, and Mr. John Mackintosh the resident clerk of works.

PRICES CURRENT OF MATERIALS.

	£.	s.	d.	£.	s.	d.
TIMBER.						
Greenheart, B.G. .....ton	6	0	0	7	10	0
Teak, E.I. .....load	8	0	0	13	0	0
Sequoia, U.S. .....foot cube	0	2	3	0	3	0
Ash, Canada .....load	3	0	0	4	10	0
Birch ,, ...	2	0	0	3	10	0
Elm ,, ...	3	10	0	4	10	0
Fir, Dantsic, &c.	1	10	0	4	0	0
Oak ,, ...	2	10	0	4	10	0
Canada	3	0	0	6	0	0
Pine, Canada red	2	0	0	3	10	0
,, yellow	2	0	0	4	0	0
Lath, Dantsic .....fathom	3	0	0	5	0	0
St. Petersburg	4	0	0	5	10	0
Wainscot, Riga .....log	0	0	0	0	0	0
,, Odessa, crown.....	2	10	0	3	0	0
Deals, Finland, 2nd and 1st...std.100	7	0	0	8	0	0
,, 4th and 3rd	5	10	0	6	10	0
Riga	5	10	0	7	0	0
St. Petersburg, 1st yellow	8	0	0	13	0	0
,, 2nd ,, ...	7	0	0	8	0	0
,, white	6	10	0	8	10	0
Swedish	6	0	0	14	0	0
White Sea	0	0	0	0	0	0
Canada, Pine, 1st	16	0	0	24	0	0
,, ,, 2nd.....	10	0	0	15	0	0
,, ,, 3rd, &c.....	6	0	0	9	0	0
,, Spruce, 1st	8	0	0	9	0	0
,, ,, 3rd and 2nd.....	5	0	0	7	0	0
New Brunswick, &c.....	5	0	0	6	10	0
Battens, all kinds	4	0	0	10	10	0
Flooring Boards, sq., 1 in., prepared, First.....	0	8	0	0	11	0
Second	0	6	6	0	7	6
Other qualities	0	4	0	0	6	0
Cedar, Cuba .....foot	0	0	3½	0	0	3½
Honduras, &c.	0	0	3	0	0	3½
Australian	0	0	2	0	0	3
Mahogany, Cuba	0	0	4	0	0	6½
St. Domingo, cargo average	0	0	4	0	0	5½
Mexican ,, ...	0	0	3½	0	0	3¾
Tobasco ,, ...	0	0	3½	0	0	5
Honduras ,, ...	0	0	3½	0	0	5
Maple, Bird's-eye	0	0	5	0	0	7
Rose, Rio .....ton	8	0	0	11	0	0
Bahia.....	7	0	0	9	0	0
Box, Turkey .....ton	5	0	0	12	0	0
Satin, St. Domingo .....foot	0	0	5	0	0	9
Porto Rico	0	0	6	0	0	10
Walnut, Italian	0	0	3½	0	0	5½
METALS.						
IRON—Bar, Welsh, in London...ton	4	15	0	5	0	0
,, ,, in Wales	4	2	6	4	10	0
,, Staffordshire, London	5	10	0	6	0	0
COPPER—						
British, cake and ingot .....ton	43	10	0	44	0	0
Best selected	44	10	0	45	10	0
Sheets, strong.....	50	0	0	0	0	0
Chili, bars	39	15	0	40	0	0
YELLOW METAL.....lb.	0	0	4½	0	0	4½
LEAD—						
Pig, Spanish .....ton	11	16	3	0	0	0
English, common brands.....	12	0	0	0	0	0
Sheet, English	13	1	3	0	0	0
SPELTER—						
Silesian, special .....ton	15	15	0	15	17	6
Ordinary brands.....	15	10	0	15	12	6
TIN—						
Straits.....ton	105	0	0	0	0	0
Australian	105	10	0	0	0	0
English ingots	108	0	0	0	0	0
OILS.						
Linseed .....ton	19	17	6	20	5	0
Cocoanut, Cochin	31	0	0	32	0	0
Ceylon	23	15	0	0	0	0
Palm, Lagos	22	0	0	0	0	0
Rapeseed, English pale	25	5	0	25	10	0
,, brown	24	0	0	0	0	0
Cottonseed, refined	21	10	0	0	0	0
Tallow and Oleine.....	25	0	0	45	0	0
Lubricating, U.S.....	5	0	0	6	0	0
,, refined.....	5	0	0	12	0	0
TURPENTINE—						
American, in casks .....cwt.	1	4	9	0	0	0
TAR—						
Stockholm .....barrel	0	14	0	0	14	6
Archangel	0	9	6	0	9	9

CONTRACTS AND PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Road-Making and Paving Works	Hammersmith Vestry...	*Official*	October 12th	ii.
Drainage, Roads, and Fencing	Putney Burial Board ...	J. C. Radford	October 13th	xii.
Construction of Railway, &c.....	Halifax Hgh. Lvl.&c. R.C	J. Fraser & Sons	October 15th	ii.
Heating Apparatus	Hanley Town Council...	*Official*	October 17th	xii.
Goods Warehouse, Oldham	L. & N. W. Rail. Co....	do.	October 19th	xii.
Workmen's Institute, &c., York	North Eastern Rail. Co.	W. Bell.....	do.	ii.
Gas-Engine House, &c.	Croydon Cor.....	T. Walker	October 20th	ii.
Underground Urinals, &c.	Com. of Sewers.....	*Official*	October 21st	ii.
Cast-Iron Work	do.	do.	October 25th	ii.
Coast Guard Station, Isle of Wight.....	Admiralty	do.	do.	ii.
Coals and Coke, Drain Pipes and Stores.....	Croydon Cor.	T. Walker	do.	ii.
Cornish Boiler	Uxbridge Local Board...	G. Eves	do.	xii.
Broken Granite and Pit Gravel, &c.	Finchley Local Board...	G. W. Brumell.....	October 31st	xii.
Public Memorial Clock, Hindley, near Wigan	.....	.....	Nov. 1st	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Surveyor and Engineer.....	Tottenham Local Board	400*l.*	October 11th	xvi.
Engineer and Surveyor.....	Shirley and Freemantle Local Board of Health	150*l.*	October 17th	xvi.
Clerk of Works	Birmingham Town Cncl.	4*l.* 4s. weekly.....	October 19th	xvi.

TENDERS.

BASINGSTOKE.—For furniture and fittings for the Basingstoke School Board. Mr. C. Bell, F.R.I.B.A., architect, 9, New Broad-street, E.C.:—

Crook & Son	£893	17	0
Collings & Graves	862	10	0
Pilne Bros.	660	0	0
Chappell	633	0	0
Goodall	627	10	0
North of E. S. F. Co.	589	9	8
Taylor	556	0	0
Heywood	549	13	0
Newbury	549	0	0
Kingbee	545	0	0
Newson	526	0	0
Educational Supply Association	519	11	10
Wake & Dean, London (accepted) ...	490	7	0

BEXHILL (Sussex).—For finishing two houses in the Western-road. Mr. J. B. Wall, architect, Walbrook:—

J. King	£520	0	0
J. Cole	487	0	0
W. Sands	480	0	0
Murrell Bros.	425	0	0

BIRMINGHAM.—For supplying the wrought-iron casements for the new Victoria Law Courts, Corporation-street, Birmingham. Messrs. Aston Webb & E. Ingress Bell, architects, 19, Queen Anne's Gate, Westminster:—

H. Hope, Birmingham (accepted).....	£663	0	0

BLACKFRIARS.—For sundry works at No. 10, Blackfriars-road, for Mr. H. W. Harris:—

Exton & Burton, Kingsland (accepted)	£103	0	0

[No competition.]

BLACKFRIARS.—For sundry works at No. 13, Blackfriars-road, for Mr. A. Cohen. Mr. C. H. Flack, architect:—

Exton & Burton, Kingsland (accepted)	£124	0	0

BOW.—For alterations to the Earl of Eglinton public-house, St. Stephen's-road, Bow. Mr. Joseph Harris, architect:—

Lusk	£255	0	0
Timson	233	0	0
Walker	195	0	0
Salt (accepted)	163	0	0

COLCHESTER.—For the alterations and additions to No. 54, Priory-street, for Mrs. E. White. Mr. J. W. Start, architect and surveyor, Cups Chambers, Colchester:—

Dupont	£193	0	0
Shead	184	0	0
Chambers	168	15	0
Ambrose (accepted)	142	0	0

EAST WICKHAM.—For the erection of a house at East Wickham. Mr. A. R. Stenning, architect:—

Douglas & Paine	£1,779	0	0
Crossley	1,656	0	0
Cooper	1,650	0	0
Duncan	1,615	0	0
Sabey & Son	1,580	0	0
Bray	1,579	0	0
Kent Building Co.	1,529	0	0

FAREHAM (Hants).—For the erection of new whiting works, cottages, stabling, chimney-shaft, and other works (exclusive of large iron roof), for Mr. Henry Rogers. Mr. Fred Bath, F.R.I.B.A., F.S.I., Crown-chambers, Salisbury, architect. Quantities supplied:—

J. & A. Gammon, Petersfield	£2,736	0	0
W. J. & C. S. Young, Salisbury	2,579	0	0
G. Stallard, Havant	2,440	0	0
H. J. Kite, Salisbury	2,414	10	6
G. H. Blackman, Fareham	2,278	12	0
J. Plummer, Fareham	2,274	7	3
W. R. & C. Light, Portsmouth	2,250	0	0
J. H. Corke, Southsea	2,030	0	0
C. Mitchell, Woodfalls, Downton*...	1,972	19	5
H. Ingram & Son, Woking†	1,960	16	0½

* Accepted, subject to deduction for gravel and cement.
† Withdrawn.

For large Iron Roof to the above.
J. Lysaght, Limited, Bristol (accepted).

GIPSY HILL.—For decorative works to General Brownlow's house, 87, Gipsy-hill. Mr. J. B. Wall, architect, Walbrook:—

Stacey Bros.	£170	0	0
P. Wilkes	135	0	0
W. Phippen	132	7	0
T. D. Leng	130	0	0

HADHAM (Herts).—For the erection of a public hall for the Much Hadham Public Hall Company, Limited:—

Cates, Puckeridge	£630	0	0
Burton, Sawbridgeworth	602	0	0
Whitaker, Standon	598	11	0
Halestrap, Hadham	547	10	6
Thurgood, Hadham	439	15	0

HAMPTON.—For repairing roof, &c., at the Girls' Orphan Home, Tangly Park, Hampton. Mr. Tabberer, architect:—

Richardson	122	15	0
Brown & Powis	117	0	0
Horwood	91	0	0
Bailey (accepted)	85	18	0

KEW.—For erecting two semi-detached villas at Forest-road, Kew, for Mr. J. T. Sharpe:—

Bowd & Lightfoot (accepted)	£600	0	0

LAVERSTOCK (near Salisbury).—For the erection of new school-buildings and other works. Mr. Fred Bath, F.R.I.B.A., F.S.I., Crown-chambers, Salisbury, architect. Quantities supplied:—

Jerrard & Stevens, Salisbury	£987	16	0
J. W. Hopkins, Wilton	936	0	0
E. Hale, Salisbury	919	0	0
Treghorn & Saunders, Laverstock	915	19	0
F. Beale, Andover	903	0	0
T. Dawkins, Barford St. Martin	889	9	0
W. J. & C. S. Young, Salisbury	852	15	0
G. Harris, Salisbury	840	0	0
Webb & Co., Salisbury	817	13	0
C. Mitchell, Downton	779	5	0
G. Dolman, Salisbury	775	6	7
H. J. Kite, Salisbury	770	0	0
H. Ingram & Son, Woking	740	19	2¾

LEIGH (Essex).—For alterations, additions, and improvements to the pottery buildings and managing director's house, for the Victoria Pottery Company, Limited. Mr. Alfred J. Hopkins, architect, 27, Mortimer-street, London. Quantities supplied:—

J. Higgs, London	£2,659	0	0
W. Spendelow, Southend	2,264	10	6
S. Darke & Son, Southend	2,090	0	0
Baker & Wiseman, Southend	2,054	10	0
J. W. Steward, Southend	1,971	0	0
Bullock & Woodiwiss, Southend	1,799	1	4

LONDON.—For erecting lecture-hall and retiring-rooms for the Directors of the Stoke Newington Assembly Rooms Company, under the superintendence of Mr. William Eve, 10, Union-court, Old Broad-street, E.C.:—

S. Page	£1,069	0	0
Woodward	1,009	0	0
Hayworth	998	0	0
Brown	948	0	0
Mills	909	0	0
Holland	900	0	0
Harris & Wardrop	886	0	0
Higgs	885	0	0
Godfrey	877	0	0
Dabbs, Amherst Park (accepted)	865	0	0

LONDON.—For the erection of a house in Wigmore-street. Mr. Leo W. Goodwyn, architect:—

Hayward & Co.	£2,313	0	0
Crossley	2,220	0	0
Durtnall	2,117	0	0
Adamson	2,015	0	0
Sabey & Son	1,827	0	0
Liddiart	1,775	0	0

LONDON.—For building additional story to warehouse, Queen-street, Mile End New Town, for Messrs. Burrell & Co. Mr. John Hudson, architect, 80, Leman-street, E.:—

Eaton & Co., Whitechapel	£398	0	0
Little, Whitechapel	380	0	0
W. Gladding, Mile End (accepted)	328	0	0

LONDON.—For alterations and repairs at 37 and 39, Cadogan-place, Pont-street, S.W., for Messrs. Richards & Son:—

Bowd & Lightfoot (accepted)	£110	0	0

LONDON.—For alterations at the Three Colts, London-wall. Messrs. Alexander & Gibson, architects, 40, Great James-street, Bedford row:—

Mattock Bros.	£1,516	0	0
Oldis	1,495	0	0
Wilkinson Bros.	1,475	14	0
Anley	1,179	0	0
Beale	1,158	0	0
Gould & Brand	1,143	0	0

LONDON.—For an extension of the Wiltshire Brewery, Hackney-road, for Messrs. Chandler & Co. Mr. F. W. Stent, architect:—

Ashby Bros.	£7,493	0	0
Bywater	7,440	0	0
Brass	7,163	0	0
J. W. Sawyer, Clapham Park-road*	6,992	0	0

* Accepted.

LYME REGIS.—For four almshouses for the Jubilee Committee, Lyme Regis, Dorset. Messrs. Stokes & Homan, architects, 31, Great James-street, Bedford-row:—

	First Tender			Amended Tender.		
Cooper, Lyme Regis	£486	3	0	£435	9	0
Randall, Lyme Regis	470	0	0	*430	0	0
Parsons & Perryman, Axminster	421	0	0	407	0	0

* Accepted.

MARYLEBONE.—For the erection of new business-premises and dwelling-house, on the site of Nos. 63 and 64, Paddington-street, Marylebone, W., for Mr. Joseph Chaplain. Mr. Thomas Durrans, architect, 44, Upper Baker-street, N.W.:—

Scott	£2,997	0	0
Foxley	2,980	0	0
White	2,973	0	0
Patman & Fotheringham	2,961	0	0
Bush	2,790	0	0
Clifton	2,784	0	0
Wall Bros.	2,752	0	0
Bywaters	2,695	0	0
Ashwell	2,679	0	0
Oldrey & Co.	2,670	0	0
Stanley Bird	2,600	0	0
Simpson & Sons	2,500	0	0
Higgs (accepted)	2,298	0	0

SOUTHSEA.—For the erection of a mission-hall' King-street, Southsea. Mr. James Newman, architect:—

Beech	£743	0	0
J. Croad	656	0	0
R. Stokes	570	0	0
H. & W. Evans (accepted)	450	0	0

SANDOWN.—For the erection of a purifying-house, Sandown, for the Sandown Gas and Coke Company, Limited Mr. James Newman, engineer:—

H. Stay	£223	0	0
J. Hayden	182	13	0
F. Colenutt	173	0	0
W. & F. Jacobs	159	0	0
R. Griffin	153	0	0
George Hayles (accepted)	136	0	0

SANDOWN.—For the erection of public offices, Sandown, for the Sandown Local Board. Mr. James Newman, architect. Quantities supplied:—

W. Jolliffe	£750	0	0
E. W. Daish	740	0	0
G. Thomas & Son	736	0	0
I. Barton	719	0	0
R. J. Sibley	699	0	0
R. Griffin	689	16	0
H. Attrill	651	0	0
G. Hayles	618	0	0
F. Colenutt	615	0	0
J. Ball (accepted)	590	0	0

TUNBRIDGE WELLS.—Proposed new house on Meadow Hill Estate, for Mr. M. A. H. Edwardes. Mr. W. B. Hughes, architect. Quantities supplied:—

Judd	£1,020	0	0
T. Ryder	1,000	0	0
Charlwood & Son	998	0	0
J. Jarvis	984	0	0
W. H. Canty	939	0	0

WEST THURROCK (Essex).—For building new club-room, stable, and other additions to the Fox and Goose public-house, West Thurrock, Essex, for Messrs. Ind, Coope, & Co., Limited. Mr. John Hudson, architect, 80, Leman-street, E.:—

Hammond & Son, Romford	£569	0	0
Eaton & Co., Whitechapel	559	0	0
W. Gladding, Mile End (accepted)	544	0	0

WOOLWICH.—For partly rebuilding and other repairs to No. 1, Hill-street, Woolwich, for Mr. J. J. Bothamley, Mr. A. T. H. Stoneham, architect, 6, Moorgate-street, E.C.:—

Bridel, Greenwich	£233	0	0

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